

ACKNOWLEDGEMENT OF HEARING LOSS BY OLDER ADULTS

By

SHERRI LYN SMITH

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Sherri Lyn Smith

Dedicated to Mary Helen Smith
A loving, devoted mother and my best friend

ACKNOWLEDGMENTS

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Abstract of Dissertation Presented to the Graduate School
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ACKNOWLEDGEMENT OF HEARING LOSS BY OLDER ADULTS

By

Sherri Lyn Smith

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Chair: Patricia B. Kricos

Cochair: Robin Lea West

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It is often reported that older individuals are reluctant to acknowledge hearing loss. The purpose of this study was to determine the extent to which older adults acknowledge hearing loss. Another purpose was to evaluate whether hearing loss acknowledgment was associated with age, gender, and overall health perceptions.

Ninety-one community-dwelling individuals, 64 females and 27 males, completed the study. Participants were 65 years of age or older and reported no history of hearing aid use prior to this study. Participants answered the self-report question "Do you think you have a hearing loss?" with a yes-no, forced-choice response. Hearing screenings were accomplished using an Audioscope3TM at 500 Hz-4000 Hz at 25 dB HL and/or 40 dB HL in each ear. The Hearing Handicap Inventory for the Elderly-Screening version (HHIE-S) was administered via a face-to-face interview. Additionally, participants rated their overall health perception using a 5-point Likert scale ranging from excellent (1) to very poor (5). Participants also completed a checklist of ten chronic health conditions.

Results indicated that 56 participants (61.5%) reported hearing loss, or responded “yes” to the self-report question (i.e., *yes respondents*). Of the 38.5% ($n = 35$) participants who responded “no” to the self-report question (i.e., *no respondents*), 85.7% ($n = 30$) passed one screening criterion (sensitivity = 80.8% and specificity = 46.2%). Only 5 participants (5.5%) failed the screening and responded “no” to the self-report question.

Mean self-perceived hearing handicap scores, measured via the HHIE-S, were significantly higher (i.e., worse) for *yes respondents* than for *no respondents*. No significant differences were found between *yes* and *no respondents* for age, gender, and health factors. Additionally, no association was found for age, gender, and health factors among *yes* and *no respondents*.

Results suggested that most of the older participants were not reluctant to acknowledge hearing loss. Although these results are encouraging, these participants do not own hearing aids. Results also suggested that various degrees of hearing loss acknowledgement may exist. Alternative treatment options were suggested depending on the degree of acknowledgment, and suggestions to expand the scope of audiologic rehabilitation were made.

CHAPTER 1 INTRODUCTION AND LITERATURE REVIEW

Hearing impairment is the third most common chronic condition experienced by older adults in America today (National Center for Health Statistics, 1995). With the growing number of older individuals in the population (Administration on Aging, 2001), the sheer number of older patients requiring audiologic services is expected to grow. Hearing impairment has been shown to produce deleterious effects on an individual's quality of life, including psychological and social implications. There is substantial evidence that regular hearing aid use and audiologic rehabilitation reduce the psychosocial impact of hearing loss in older adults (Mulrow et al., 1990; Mulrow, Tuley, & Aguilar, 1992). However, it is estimated that only 10-21% of older adults with hearing loss actually own hearing aids (Jerger, Chimel, Wilson, & Luchi, 1995; Kricos, 1995) and nearly 30% of hearing aid owners discontinue using them (Popelka et al., 1998). Many reasons have been postulated for the lack and/or discontinuance of hearing aid use among older adults with hearing loss.

In spite of the evidence that untreated hearing loss in older adults may lead to a reduced quality of life and that treatment of hearing loss is beneficial, audiologists frequently lament that many older adults deny their hearing losses and hearing problems (Hétu, 1996; Jerger et al., 1995; National Council on the Aging, 1999). In fact, a reason frequently postulated for lack of hearing aid use in older adults is denial of hearing loss (Maurer, 1998; Rawool, 2000).

The purpose of this study was to examine the extent to which older adults acknowledge their own hearing losses. In addition, an objective of this study was to determine whether factors such as age, gender of individual, and health are associated with hearing loss acknowledgement.

Hearing Loss in Older Adults

Prevalence

It is estimated that one-third of individuals 65 years of age and older report some degree of hearing loss (Weinstein, 2000). Numerous investigators have documented the prevalence of hearing loss in older adults, with reports ranging from 30% to 100% depending on the definition of hearing loss used by the researcher or the environment in which the older adults resided (Kricos, 1995).

One fact that is agreed upon in the literature is that the prevalence of hearing loss increases as age increases. It is estimated that 25% to 40% of individuals ages 65+ years have a hearing loss, with prevalence rising to more than 70% to 80% for those over the age of 70 or 80 years (Bess, 2000). Others estimated the prevalence of hearing impairment for individuals ages 65-74 years as being approximately 33%, rising to 45% for older individuals ages 75-84 years, and 62% for persons 85 years and older (Gold, Lightfoot, & Hnath-Chisolm, 1996). Finally, it is suggested that the prevalence of hearing loss is on the rise for older individuals (Wiley, Cruickshanks, Nondahl, & Tweed, 2000).

Aging Auditory System

Senescent changes occur in all components of the auditory system. In other words, age-related changes can be observed in the outer ear, middle ear, inner ear, and central auditory system.

In the outer ear, there may be a loss of elasticity and collagen. This loss is thought to make older adults vulnerable to collapsible external auditory canals (Weinstein, 2000). It is estimated that 30-40% of older adults have collapsible ear canals (Silman & Silverman, 1991). In addition, epithelial tissue thins in the outer ear, making it more vulnerable to trauma. In the external auditory canal, hair follicles thicken and there is a disruption in the cerumen gland production. Specifically, fewer cerumen glands excrete cerumen, which in turn becomes less viscous and drier. As a result, cerumen impaction in older adults is common (Weinstein, 2000). Gleitman, Ballachanda, and Goldstein (1992) reported that approximately one-third of the 65-74 year-old participants in their study had impacted cerumen and approximately 20% of the participants ages 75-84 years had cerumen impaction.

Changes in the aging middle ear occur, yet they appear to be minor and have little to no effect on hearing sensitivity or middle ear function. Examination of older adults has suggested that the tympanic membrane becomes slightly stiffer, thinner, and more translucent. Middle ear muscles and ligaments atrophy. Although these changes may have no effect on pure tone audiometry results, subtle differences may be noted on immittance testing (Weinstein, 2000).

Age-related changes in the inner ear were first postulated by Schuknecht (1955) via postmortem histological examinations. He suggested that there is significant degeneration and loss of various cells and structures in the inner ear. Weinstein (2000) cited specific studies that reported aging-related changes in the inner ear, such as loss of outer hair cells, inner hair cells, and spiral ganglion cells, all of which account for hearing loss in older adults.

Central auditory nervous system (CANS) changes are thought to result from deprivation due to peripheral pathology, in part. In addition, changes in the aging brain such as atrophy and neuronal death are thought to degenerate structures in the CANS. These changes are believed to contribute to poorer auditory processing abilities in older adults (Stach, Spretnjak, & Jerger, 1990).

Audiologic Findings in Older Patients

Anatomical and physiological changes in the auditory system affect findings on many behavioral tests used in audiologic examinations. Examples of behavioral tests include pure tone audiometry, word recognition, and auditory processing disorder (APD) tests. Generally, findings on these measures can be characterized for older adults.

Measurable hearing sensitivity progressively declines as one ages. There is an approximate 30 dB HL decline in the higher frequencies (2000 Hz to 8000 Hz) as one ages from 65 years to over 85 years for both women and men. In the middle frequencies (around 1000 Hz), there is an approximate decline of 30 dB HL for women and 20 dB HL for men from ages 65 years to over 85 years. Finally, from ages 65 to over 85 years, the lower pitches (250 to 500 Hz) decline by approximately 10 dB HL for both men and women. Figures 1-1 and 1-2 depict a graphical representation of hearing sensitivity as men and women age, respectively (Moscicki, Elkins, Baum, & McNamara, 1985).

Naramura et al. (1999) evaluated 747 patients ages 65-98 years. They reported that hearing sensitivity was worse for their subjects who were older, but did not show a further decline for subjects 85 years of age and older. In other words, they suggested that hearing sensitivity, albeit progressive, may actually stabilize and plateau in very old individuals 85 years of age and older.

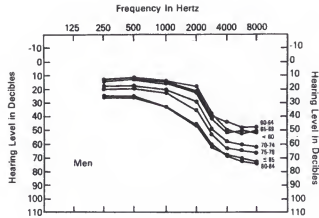


Figure 1-1. Hearing sensitivity in elderly men (Moscicki et al., 1985)

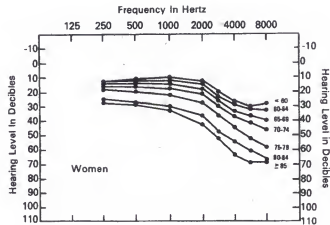


Figure 1-2. Hearing sensitivity in elderly women (Moscicki et al., 1985)

Speech recognition abilities also decline as one ages, but more rapidly in men than women. Chessman (1997) reported that after 60 years of age, speech recognition declines by approximately 13% per decade for men and 6% per decade for women when evaluated in a quiet environment using monosyllabic words. Differences in word recognition scores were obtained from elderly patients with similar hearing impairments. Therefore, it is conceivable that a 95-year-old woman might have word recognition abilities approximately 18% poorer than a woman 65 years of age with the same degree

of hearing loss. For men with a 30 year age difference, an older man might exhibit a 36% poorer word recognition score than a younger man with the same hearing sensitivity. In short, older adults' abilities to understand words in quiet environments become progressively poorer with each passing decade of life.

Auditory processing abilities have been shown to decline in many older adults, however, these abilities are highly variable (Stach et al., 1990). Additionally, the prevalence of auditory processing disorders in older adults remains unclear (Jerger et al., 1995). There are, however, data to support decreased performance of older individuals on auditory processing tests of degraded, competing or altered speech (Kricos, 1995), temporal resolution, and frequency resolution (Phillips, Gordon-Salant, Fitzgibbons, & Yeni-Komshian, 2000).

Special Considerations for Audiologic Services with Older Adult Patients

As indicated earlier, there are senescent characteristics in the auditory system and in audiologic findings. In addition, age-related changes also occur in other parts of the body that may affect vision, memory, learning, attention, and cognition. Because of these changes, special considerations should be taken when serving elderly patients in an audiology clinic.

First, external auditory canals should be free of cerumen and excessive hair. Insert earphones should be used during behavioral testing in the sound booth to avoid consequences of collapsible ear canals on these measures. More time should be allowed for test administration and response time. The basic audiologic battery should also include some measure of central auditory function (Holmes, 1995; Weinstein, 2000). Lastly, accommodations should be made for visual deficits (Smith, Kricos, & Holmes,

2001) and for age-related changes affecting memory and learning (Smith & Kricos, 2002).

Psychosocial Implications of Hearing Loss

Hearing loss in older adults often has negative psychosocial implications. It is not uncommon for individuals with untreated hearing loss to suffer from depression, loneliness, social isolation or withdrawal, fear, anger, or frustration (Kricos, 1995). It has even been suggested that there is a correlation between hearing loss and cognitive decline (Naramura et al., 1999). Many scales have been developed to assess the psychosocial implications of hearing loss in older adults. These scales have also been used in studies as outcome measures.

Self-perceived hearing handicap is often associated with hearing loss. Ventry and Weinstein (1982) developed the 25-item Hearing Handicap Inventory for the Elderly (HHIE) to assess the emotional and social impact that hearing loss has on older adults. It is one of the most widely used scales for assessing hearing handicap in the elderly. Scores on the HHIE range from 0-100, with lower scores suggesting less hearing handicap. Oral-interview administration of the HHIE, as compared to paper-pencil administration, has been shown to produce less variability and better test-retest reliability. Face-to-face interview has been suggested as the administration method of choice (Weinstein, 1990; Weinstein, Spitzer, & Ventry, 1986). A screening version of the HHIE has also been developed and is called the HHIE-screening version or HHIE-S (Ventry & Weinstein, 1982).

Depression has been found to be more prevalent in individuals with hearing loss compared to those individuals with normal hearing. Hearing loss may not cause depression per se; however, it may make people more vulnerable to psychological

problems such as depression (Andersson, Melin, Lindberg, & Scott, 1995). Depression is positively correlated with the severity of hearing loss, but not with type of hearing loss, tinnitus, or hearing aid use (Jones & White, 1990).

Naramura et al. (1999) demonstrated that hearing level was associated with depression. They tested community-dwelling Japanese elders (209 males and 538 females) ages 65-98 years of age. They found that depression scores on the Self-Rating Depression Scale (Zung, Richards, & Short, 1965) positively correlated with hearing sensitivity.

Cacciatore, Napoli, Abete, Marciano, Triassi, and Rengo (1999) measured depressive symptoms of older adults who were hearing impaired using the Geriatric Depression Scale (Brink et al., 1982). The GDS consists of 30 items in which the patients respond with a “yes” or “no.” Scores of 10 or 11 are used as the cut-off scores to label patients as depressed or non-depressed. Sub-threshold scores are indicative of no depression (Gallo, Flumer, Paveza, & Reichel, 2000). Cacciatore et al. (1999) administered the GDS to 1,332 elderly people, ages 65 to 96 years, and found that higher GDS scores correlated with increased severity of hearing loss.

Mulrow et al. (1992) used the GDS-screening version to measure baseline depression status in 192 elderly veterans ages 66-78 years. They considered a score of greater than 5 as significant for depression. Of those interviewed, 23% had scores greater than 5.

An individual’s overall affect may be deleteriously influenced by the presence of hearing loss. The Positive Affect Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) has been used to assess one’s affect in relationship to a variety of

situations or disorders. The PANAS consists of 20 feeling or emotion words.

Respondents are asked to rate each word in relation to how they feel on average, using a 5-point Likert scale in which “1” represents “very slightly or not at all” and “5” represents “extremely.”

Loneliness and self-esteem have been shown to be associated with hearing loss. Chen (1994) examined the correlation between loneliness and self-esteem with hearing loss in the elderly. Questionnaires such as the HHIE (Ventry & Weinstein, 1982); the UCLA Loneliness Scale (Russel, Peplau, & Cutrona, 1980); and the Rosenberg Global Self-Esteem Scale (Rosenberg, 1965) were administered to 89 older adults ages 65-90 years. Results indicated that hearing handicap, measured on the HHIE, was significantly correlated with loneliness and self-esteem. Higher hearing handicap correlated with greater loneliness and lower self-esteem.

Hearing loss and decreased cognitive function have been shown to be correlated. In the Naramura et al. (1999) study, cognitive function was measured via the Mini-Mental State Exam (MMSE; Folstein, Folstein, & McHugh, 1975). A total score of less than 23 suggests a cognitive impairment. Naramura et al. (1999) reported that poorer hearing levels were associated with poorer MMSE scores.

It is evident that negative consequences of hearing loss are experienced by older adults. Hearing loss has a direct impact on the communicative function of older individuals. Additionally, hearing loss has a destructive influence on psychosocial aspects of an older adult's life, which may lead to an overall reduction in the quality of life in individuals who suffer from hearing loss. Therefore, it is recommended that older adults

seek treatment for their hearing needs to alleviate the deleterious impact of this chronic condition.

Hearing Aid Use by Older Adults

The provision of hearing aids is the most common therapy used to treat hearing loss in older adults (Holmes, 1995); however, there is considerable underutilization of amplification in the elderly (Popelka et al., 1998), despite its benefits. It is estimated that only 10-24% of elderly with hearing loss actually use hearing aids (Jerger et al., 1995). Even though there is an under-use of hearing aids by older adults, the majority of hearing aid users are elderly, especially the very old (Weinstein, 2000).

Not only is there underutilization of hearing aids by older adults, but there is a significant discontinuance rate of hearing aid use among elderly patients. Many older adults who own hearing aids do not use them on a regular basis. Popelka et al. (1998) surveyed nearly 6000 individuals as part of a longitudinal study. They found that 29.3% of the hearing aid owners no longer used their hearing aids. Gates, Cooper, Kannel, and Miller (1990) found that 22% of their participants who owned hearing aids did not use them any longer.

Trychin (2001) suggested 18 possible reasons for lack of hearing aid use by the elderly. These included higher priorities, cost, lack of transportation, family resistance, fear of being seen as a failure, unwillingness to give up the “benefits” of having the hearing loss as an excuse, fear of doctors, dexterity problems, bad experiences with hearing aids for themselves or someone they know, overstimulation, emotional status, ear pain, vanity, and fear of ridicule. Another factor contributing to the low rate of hearing aid use by older adults is denial of hearing loss (Hansen, 1998; Maurer, 1998).

Reluctance to Acknowledge Hearing Loss or Hearing Impairment

Hétu, Jones, and Getty (1993) suggested that aversion to hearing loss acknowledgement might be observed in different ways. One way was through denial. Lack of acknowledgment may also be seen by individuals with hearing loss who minimize the problem or the impact of the problem. Some individuals may not be comfortable sharing problems with other individuals, and therefore are reluctant to acknowledge hearing loss. And finally, Hétu and his coauthors suggested that reluctance to acknowledge hearing loss may be a way of normalizing the loss. In this section, a review of the literature relating to hearing loss acknowledgement, or lack thereof, and possible factors affecting acknowledgement will be explored.

Denial

In psychological terms, denial is an unconscious defense mechanism whereby individuals refuse to acknowledge painful feelings or thoughts, or possibly even realities. Kyle, Jones and Woods (1985) suggested that up to 75% of individuals with hearing loss deny their loss. They also suggested that denial of hearing loss can last anywhere from a few days to decades.

Maurer (1998) reported that the “cardinal quandary” (p. 30) for an audiologist trying to rehabilitate older patients with hearing loss is that that older patients deny their hearing losses. Individuals with hearing loss who are not willing to acknowledge the loss are at risk to develop psychosocial problems as a result. According to Erler and Garstecki (2002), lack of hearing loss acknowledgement gravely impedes the adjustment and rehabilitative process (i.e., seeking professional help and/or adhering to treatment recommendations). Therefore, it is vital to understand acknowledgement and the factors that relate to hearing loss acknowledgement, so that interventions can be developed to

help individuals to accept their hearing difficulties and to avail themselves of rehabilitative options.

Stigma of Hearing Loss

The stigma associated with having hearing loss might be one reason for lack of acknowledgment. In fact, stigmatizing perceptions of hearing loss most often result in denial of hearing difficulties (Erler & Garstecki, 2002). Stigmatizing perceptions of hearing loss include feelings of being inadequate, abnormal, intellectually inferior, old, and having a reduced ability to interact with others (Hétu, 1996; Hétu et al., 1993).

Coping

Wiley and his coauthors (2000) suggested that older adults may have better coping skills for disabilities and therefore are less bothered by the impact of problems resulting from disabilities. In their study, they evaluated the association between audiometric data and self-perceived hearing handicap measured via the HHIE-S. Their findings suggested that there is increased self-perceived hearing loss in older adults compared to younger adults. However, when they accounted for degree of hearing loss, they found that older adults had less self-perceived hearing handicap than younger adults. Based on their study, they suggested that, after adjusting for severity of hearing loss, older adults' self-perceived hearing handicap declines approximately 24% every 5-year advancement in age. They suggested that this finding may be because older adults expect more disabilities and therefore learn to cope with the problems that arise from having them. On the other hand, Garstecki and Erler (1999) suggested that coping with hearing loss may cause feelings of vulnerability or even indebtedness.

Gender

Hétu et al. (1993) found that hearing difficulties significantly impacted intimate relationships and that these relationships were especially important to women. They suggested that because women traditionally are in roles that involve communication, they might be more negatively impacted by a hearing loss than men, and thus are more likely to take ownership of their hearing loss. On the other hand, they suggested that men are more likely to admit they cannot hear sounds like a doorbell or a telephone ring, but that not understanding the majority of a conversation on the telephone is not problematic. Instead of acknowledging hearing problems, men are more likely to use maladaptive strategies (i.e., pretending to understand) in communication situations.

Garstecki and Erler (1999) evaluated hearing problems and negative reactions to hearing difficulties by men and women using the Communication Profile for the Hearing Impaired (CPHI), a scale developed by Demorest and Erdman in 1987. They found that females reported significantly more hearing problems and negative reactions to hearing problems than did men on the CPHI. They also reported that this finding needs further investigation because the CPHI is a self-report measure and it may be that men experience the same problems and negative reactions to hearing loss, but they are less willing to report it.

Age

It has been suggested that older adults are more willing to admit hearing loss than are younger adults (Erdman & Demorest, 1998). Hearing loss stigma in women was studied by Erler and Garstecki (2002) as a function of age. In this study, participants were divided into three groups: younger women (35-45 years), middle-aged women (55-65 years) and older women (75-85 years). All participants reported normal hearing. One task

given to the participants was a selected semantic differential task in which participants answered the sentence, “If someone has a hearing loss, other people think of them as ____.” (p. 85), by putting a mark on one of seven boxes that were evenly spaced between a pair of words (e.g., dumb/smart). With this method, the authors found that perceptions of hearing loss stigma were most positive for participants in the oldest group (i.e., judgments made on the differential task were more towards the positive end of the scale) and most negative for women in the youngest group.

Successful Aging

Pichora-Fuller and Robertson (1994) suggested that denial of hearing loss is just successful aging. In other words, older adults accept hearing problems as part of the normal aging process. Because of the normalcy attached to age-related hearing declines, older adults may feel that it is unnecessary to seek treatment (van den Brink, Wit, Kempen, & van Heuvelen, 1996).

Hétu et al. (1993) also suggested that reluctance to admit hearing loss might occur in individuals who normalize their hearing losses. Because hearing loss is a normal part of the aging process, it is conceivable that older adults with hearing loss might not report hearing difficulties because they believe that hearing difficulties are “normal” for older adults.

Hansen (1998), on the other hand, described psychological survival as being second to physical survival. He suggested that older adults, by not acknowledging a hearing loss, are protecting their identity or view of themselves.

Unawareness of Hearing Loss

Before hearing loss acknowledgement can take place, individuals must realize that they have hearing difficulties. However, the nature of presbycusis is not conducive for

acknowledgement. As a person gets older, there are ever so slight declines in hearing sensitivity, mainly in the higher frequencies. It is not uncommon for older individuals to hear low-frequency sounds within normal hearing levels. These changes occur so slowly, in most cases, that an individual often adjusts and establishes a new mental baseline for “normal hearing” (Maurer, 1998).

Hétu et al. (1993) reported that individuals who suffer from hearing loss for many years and are reluctant to acknowledge the loss, may be unaware of the loss or the extent of the loss. However, if these individuals start wearing assistive listening devices, they are often surprised to discover that they have been missing sounds for such a long period of time. It may be that these individuals adapted to the subtle changes in their hearing over time, reassessed their self-perceived baseline for normal hearing, and were unaware of the hearing difficulties they were experiencing over the years.

On the other hand, McDavis (1983) evaluated the association between denial of hearing loss and severity of hearing loss in older adults. Her hypothesis was that denial of hearing loss would be less prevalent in individuals with more severe hearing loss as their communication problems would be more obtrusive. She found inconclusive evidence in her study to suggest that denial of hearing loss was dependent upon severity of hearing loss. However, she did note that a trend in the data to support that denial seems to peak for those individuals with a mild-moderate loss, and decline for those individuals who had a hearing loss that was more severe than 50 dB.

Health

In his description of reasons why individuals with hearing loss do not pursue hearing aids, Trychin (2001) suggested that one reason was that an individual might have other priorities. This also may be a reason affecting whether older adults acknowledge

hearing difficulties as well. An older individual might have other chronic health conditions that are viewed as more important than hearing difficulties (Maurer, 1998). Approximately, 50% of older adults, ages 60 years and older, have at least two or more chronic health conditions. Approximately 25% of older adults have three or more chronic health conditions and less than 10% have four or more chronic health conditions (Guralnik, LaCroix, Everett, & Kovar, 1989). Studies have also suggested that severity of hearing loss is correlated with poorer health perception (Bess, Lichtenstein, Logan, Burger, & Nelson, 1989; Pugh & Crandell, 2002). Therefore, it is conceivable that older adults with health problems might acknowledge hearing difficulties less often than healthy older adults if they view these other chronic health conditions as more important or serious.

Screening Methods for Hearing Loss and Hearing Handicap in Older Adults

In order to know if individuals acknowledge hearing loss or hearing problems, their hearing status must be determined. Many studies have been conducted to evaluate various ways to screen hearing sensitivity and/or hearing difficulties of older individuals (Yueh, Shapiro, MacLean, & Shekelle, 2003). Pure tone screening methods as well as self-perceived hearing handicap screening methods have both been used. The AudioScope™ and the Hearing Handicap Inventory for the Elderly-Screening Version (HHIE-S) have been used frequently as screening tools.

The AudioScope3™ (Welch Allyn, Inc., Skaneateles Falls, NY) is a pure tone screening instrument that is built into an otoscope. With this instrument, a professional can perform an otoscopic ear exam using one of three specula sizes. In addition, a pure tone screening can be accomplished by a push of a button. There are three intensity levels from which to choose: 20 dB HL, 25 dB HL, and 40 dB HL. Once the screening level has

been selected, a “start” button is pressed. This will then begin the screening protocol in which a 1000 Hz practice tone is presented at 20 dB SL, followed by pure tones presented in the order of 1000 Hz, 2000 Hz, 4000 Hz, and 500 Hz. The timing of the presentation pure tones is random to prevent patients from predicting when a pure tone will be presented. A picture of the AudioScope3™ with speculum can be seen in Figure 1-3 (Welch Allyn, 2003).

Another tool commonly used to screen hearing is the HHIE-S (Ventry & Weinstein, 1983). This questionnaire was designed to assess the emotional and social consequences of hearing loss, or a self-perceived hearing handicap. The HHIE-S was developed based on the full version of the HHIE (Ventry & Weinstein, 1982) that was described above. The HHIE-S version has two subscales, an emotional subscale and a social subscale. It consists of 10 questions in which the patient responds with a “yes,”



Figure 1-3. A picture of the Welch Allyn AudioScope3™ instrument with speculum.

“sometimes,” or “no” response. The responses are scored as follows: 4 points for “yes,” responses, 2 points for “sometimes” responses, and 0 “points” for no responses. An

emotional subscale score, social subscale score, and total score are then calculated based on participant responses to the 10 items. Lower total scores are suggestive of no or slight self-perceived hearing handicap, and higher scores suggest significant self-perceived hearing handicap. A total score that is greater than 10 is suggested as a pass/fail criterion when using the HHIE-S as a screening tool (Ventry & Weinstein, 1983; Weinstein, 2000).

Lichtenstein, Bess, and Logan (1998b) validated the use of a Welch Allyn AudioScope™ and the HHIE-S as screening tools to identify older adults with hearing loss. Participants completed a pure tone threshold assessment, an AudioScope™ screening at 40 dB HL, and the HHIE-S. The AudioScope™ used in this study was an earlier model than previously mentioned. With this model, there was only one intensity level from which to choose which was 40 dB HL. Pass-fail criteria for the pure tones assessed were “(1) a 40-dB loss at the 1000 Hz or 2000 Hz frequency in both ears or (2) a 40-dB loss at the 1000- and 2000-Hz frequencies in one ear.” (p. 2876). The HHIE-S screening used a cut-off score of 8. The sensitivity of the AudioScope™ used was 94% and the specificity ranged from 72% to 90%. The HHIE-S had a sensitivity of 72% to 76% and a specificity of 96% to 98%. The authors suggested that both the AudioScope™ and the HHIE-S were valid screening tools to assess hearing loss in older adults.

In another study, Lichtenstein, Bess, and Logan (1988a) evaluated the performance of the HHIE-S against five different definitions of hearing loss (Ventry & Weinstein [1983], speech-frequency pure tone average, high-frequency pure tone average, speech recognition thresholds, and word recognition scores). Participants, 178 elderly patients, were screened in a primary care office. They found that the HHIE-S had sensitivities of

53-72% and specificities of 70-84%. The authors concluded that the HHIE-S was an adequate screening tool for hearing loss in the elderly.

McBride, Mulrow, Aguilar, and Tuley (1994) evaluated 185 elderly individuals aged 60 and older via a convenience sample in a primary care office. They were randomly given the HHIE-S and underwent a hearing screening via the AudioScope™. They defined a hearing loss as a better-ear threshold of 40 dB HL or greater at 2000 Hz via the pure tone screening. Participants also completed a diagnostic audiologic evaluation. The screening results were compared to three definitions of hearing loss which included a speech frequency pure tone average of greater than 25 dB, a high-frequency pure tone average of greater than 25 dB, and a 40 dB loss at 1000 Hz or 2000 Hz as suggested by Weinstein and Ventry (1983). Sensitivities and specificities of the HHIE-S (sensitivity: 29% to 63% and specificity: 75% to 93%) and AudioScope™ (sensitivity: 64% to 96% and specificity: 80% to 91%) as screening tools were reported. The AudioScope™ was found to be the better screening tool than the HHIE-S when compared to a variety of definitions of hearing loss and was also preferred by participants.

Screening Criteria for Hearing Loss and Hearing Handicap in Older Adults

Many different criteria have been used to identify hearing loss in older individuals as one can see in the literature review above. However, there is a debate within the audiology community as to the best criterion to use, especially when it comes to a pure tone screening criterion.

The debate primarily centers on whether to use a 25 dB HL fence or a 40 dB HL fence, as a cut-off level, regardless of age. The American Speech-Language-Hearing Association (ASHA, 1997) developed a guideline that suggested a failure if a patient does

not respond to a 25 dB HL presentation level at 1000 Hz, 2000 Hz, and 4000 Hz in both ears. If an individual responds to a 25 dB HL pure tone at each of these frequencies in both ears, then a “pass” is assigned. The ASHA criterion is the same for all adults (ages 18+), irrespective of age. ASHA contends that a hearing loss greater than 25 dB HL, a commonly used definition of audiometrically normal hearing, should apply to adults because hearing thresholds exceeding 25 dB HL can affect communication, despite the age of the individual. It is interesting to note that the performance (i.e., sensitivity and specificity) of this criterion has not yet been validated (Weinstein, 2000).

Leaders in the audiology community, however, have recommended a higher fence than that suggested by ASHA (i.e., 40 dB HL) as most of the older adults in America would fail a screening criterion of 25 dB HL. They contend that the goal of a screening should not be to identify all individuals with even a minimal hearing loss because they would most likely not report communication difficulties, seek professional help, or comply with treatment recommendations. Ultimately, these audiologists feel the goal should be to identify individuals with significant hearing problems who might be more willing to comply with treatment recommendations. Most researchers using pure tone screening to assess older adults’ hearing opt for a higher fence than that suggested by ASHA (Weinstein, 2000).

Recommendations for screening self-perceived hearing handicap via the HHIE-S have been made by ASHA and also by Ventry and Weinstein (1983). A suggested cut-off score of 8 was made by ASHA (i.e., scores greater than 8 will constitute a referral for a follow-up hearing evaluation), whereas the authors of the HHIE-S suggested a cut-off score of 10. ASHA bases their recommendation on a study by Lichtenstein et al. (1988a)

described above. However, Ventry and Weinstein recommend a referral for a follow-up hearing evaluation for scores of more than 10, based on their study (1983).

Self-Reported Hearing Loss

Studies have been conducted to determine whether older individuals accurately report hearing loss. In these studies, participants are often asked a self-reported hearing loss question of some kind and typically undergo a screening protocol to assess whether they pass or fail based on a certain definition of hearing loss.

Clark, Sowers, Wallace, and Anderson (1991) conducted a study to evaluate the accuracy of self-reported hearing loss by older women using a pure tone criterion. In this study, 267 older women underwent audiometric testing under headphones. Thresholds were determined from 500 Hz through 4000 Hz in each ear. Pure tone hearing thresholds were averaged for 1000 Hz and 2000 Hz or the average between 1000 Hz, 2000 Hz, 3000 Hz, and 4000 Hz. Criterion levels of 25 dB HL and 40 dB HL were used for each average threshold score. Participants answered the self-report question, "Would you say that you have any difficulty hearing?" (p. 705). Thirty-five of the participants reported hearing difficulties. Depending on the criteria for the definition of hearing loss (i.e., 25 dB HL or 40 dB HL), the percentage of participants with hearing loss ranged from 11% for losses of 40 dB HL to 60% for losses of 25 dB HL. The performance of the self-report question against the different definitions of hearing loss was compared. It was determined that the self-reported hearing loss, using the higher fence as the standard (40 dB HL mean loss at 1000 and 2000 Hz or 1000 Hz – 4000 Hz), was a sensitive (81% and 70 %, respectively) and specific (74% and 77%, respectively) indicator of hearing loss.

Although the results of this study indicated that older women are generally accurate (i.e., agreement between self-reported hearing loss and pass/fail assignment) when

reporting hearing loss, their findings may have shown more accuracy for participants not reporting hearing loss as their pure tone assessment methodology might have been falsely elevating the thresholds of some participants. Recall that older adults are prone to collapsible ear canals (Weinstein, 2000). Due to this, insert headphones are the preferred transducer when testing older adults (i.e., they prevent the ear canal from collapsing), instead of circumaural headphones as used by Clark et al. (1991), which may induce collapsible ear canals, resulting in falsely-elevated thresholds. Therefore, there may have been participants who responded “no” to the self-report question and failed the hearing screening due to collapsible ear canals, rather than a hearing loss.

A different self-report question was used to determine the value of self-identified hearing loss by Dancer and Jackson (1996). Their participants answered the self-report hearing loss question, “Do you have any loss of hearing at the present time?” (p. 114). In this study, 100 older adults answered this question with a yes or no response and completed a hearing screening at 40 dB HL at 2000 Hz. They also completed the Self-Assessment of Communication (SAC) which was developed by Schow and Nerbonne (1982). The SAC is a scale assessing communication difficulties in which patients respond to questions using a 5-point Likert scale of (1) almost never to (5) practically always. A score greater than 18 was used as a pass/fail criterion for the SAC and failure to respond to a 40 dB HL tone at 2000 Hz in either or both ears constituted a failure for the pure tone screening. Results suggested that more than 54 participants answered no to the self-report question. Of these participants, 89% passed the pure tone screening and 98% passed the SAC. On the other hand, 46 participants reported yes to the self-report question. Of these participants, 74% failed the pure tone screening criterion and 46%

failed the SAC criterion. Only six participants who reported no to the self-report question failed the pure tone criterion and only one participant who reported no to the self-report question failed the SAC criterion. These results suggested that very few older participants denied hearing loss or hearing difficulties when they were present. These authors suggested that using the self-report question as a screening tool is itself an adequate method for screening older adults with hearing loss and/or hearing difficulties.

Purpose of Study

Maurer (1998) suggested that denial of hearing loss is the single-most cited reason why older individuals do not comply with treatment recommendations (i.e., provision of hearing aids). Kyle et al. (1985) suggested that approximately 75% of individuals with hearing loss deny the hearing loss. On the other hand, Dancer and Jackson (1996) and Clark et al. (1991) reported that the majority of older adults in their study reported hearing loss (i.e., acknowledged hearing loss) and did so accurately.

Therefore, the purpose of this study was to determine whether older adults, who are not using hearing aids, acknowledge hearing loss when a hearing loss and or self-perceived hearing handicap is present. Another purpose of the study was to determine whether other factors might contribute to hearing loss acknowledgement as has been suggested. These factors include age (Erler & Garstecki, 2002), gender (Héту et al., 1993), and other health priorities (Maurer, 1998). The research design and methodology will be discussed in the next chapter.

CHAPTER 2

METHODS

The primary purpose of this study was to determine the extent to which older adults acknowledge hearing loss. Another purpose of this study was to evaluate the relationship between self-perceived hearing handicap and self-reported hearing loss. An additional purpose of the study was to determine if age, gender, overall health perception rating, and number of chronic health conditions had an impact on acknowledgement of hearing loss. Finally, varying operational definitions of hearing loss were used to determine which one showed the strongest relationship to self-reported hearing losses in older adults. The methodology and hypotheses used to evaluate the aforementioned relationships will be discussed in detail below.

Inclusion and Exclusion Criteria

To be included in the study, individuals had to meet three main criteria based on age, written and spoken communication abilities, and hearing aid history. For the age criterion, individuals had to be 65 years of age or older. An individual's age was determined by their self-reported date of birth. Because individuals were required to undergo an informed consent process and to be able to answer the study questions, they had to have the ability to read and understand American English. Finally, individuals with a history of hearing aid use were excluded from participation in the study because presumably hearing aid users already would know their diagnosed hearing status.

Recruitment of Participants

Participants were recruited from the Gainesville, Florida community and outlying areas within 150 miles of the University of Florida. Flyers were posted around the University of Florida campus and at area retirement communities. Flyers were also mailed to individuals who were in a psychology research project at the University of Florida. A copy of an original flyer can be found in the Appendix. Announcements and advertisements of the study were also made through community list-serves, health fairs, and aging organization networking meetings.

Most participants were recruited from area retirement communities. The principal investigator made arrangements with staff at three facilities to conduct the study on their premises. These facilities were *The Village Retirement Center* and *The Atrium* in Gainesville, Florida and the *Advent Christian Village* in Dowling Park, Florida. Flyers were posted around these facilities and advertisements appeared in facility newsletters and/or on a closed-circuit television station within the facility. In all advertising media, it was clearly stated that the researchers conducting this project were interested in completing “a hearing study with older individuals who thought they had hearing loss and with older adults who thought they had normal hearing.” These advertisements were worded in this fashion to attempt to recruit individuals with a wide variety of opinions about their hearing status as opposed to recruiting only those who thought they had hearing loss. All other older individuals recruited outside of the three aforementioned retirement communities were advised to contact the principal investigator to complete the study protocol at the University of Florida Speech and Hearing Clinic in the Department of Communication Sciences and Disorders. Participants who completed the study

protocol at the University of Florida Speech and Hearing Clinic were not patients of the clinic, but came to the clinic specifically for this research project.

Through the aforementioned recruitment process, 95 individuals were recruited for the study. Of these individuals, three were recruited from *The Village Retirement Center* and five were recruited from *The Atrium*. Twenty-two individuals were recruited from the community at large and were seen at the University of Florida Speech and Hearing Clinic. Finally, the majority of older adults, 65 in total, were recruited from *Advent Christian Village*.

Procedure of Study

The following study protocol and aforementioned recruitment procedures were approved by the University of Florida Institutional Review Board (Protocol #2001-603). Prior to conducting the study protocol, individuals were asked to read and sign an informed consent letter. It should be noted that this letter was typed in size 16-point, Times New Roman font as suggested for written materials designed for older individuals (Smith et al., 2001). A copy of the informed consent letter can be seen in the Appendix.

Participants were seated in a quiet room with only the researcher and/or research assistant. If a significant other accompanied the participant to the study session, he or she was asked to wait in the waiting room. To confirm their qualifications for the study, participants were asked their date of birth and if they had had prior hearing aid use.

The study had two parts. The order of presentation of the two parts was counter-balanced across participants. One part focused on assessment of the participant's hearing status via pure tone screening audiometry and visual inspection of the outer and middle ear via otoscopy. The other part of the study focused on study questions and completion of study questionnaires via face-to-face interview. The researchers and research assistants

attempted to use clear speech when asking questions in the face-to-face portion of the study.

For the question part of the study, participants answered two self-report questions and two questionnaires. First, the self-report question “Do you think you have a hearing loss?” was asked. The participants answered with a yes-no, forced-choice response.

Secondly, participants were asked to rate their perceived overall health. Specifically, participants were asked the question “If you were to rate your overall health, would you say excellent, good, fair, poor, or very poor?” Only one response was accepted from the participant. For example, if a participant’s response was “hmmm...somewhere between excellent and good”, then a follow-up question was asked which was “If you had to pick only one choice of excellent, good, fair, poor, or very poor to describe your overall health, which one would you choose?”

The third item completed in the question part of the study was the Hearing Handicap Inventory Elderly-Screening version (HHIE-S) which was administered as recommended by the authors, and scored immediately (Ventry & Weinstein, 1983). This scale consists of 10 questions about a “hearing problem.” Individuals are asked to respond with a “yes,” “sometimes,” or “no” response for each question which are scored with points worth 4, 2, or 0, respectively. The 10 questions are divided into an emotional subscale and a social subscale. Each subscale is scored and the total of both subscale score are added to make up a total score. Total scores can range from 0 to 40. Lower total scores are suggestive of no to minimal self-perceived hearing handicap and higher scores are suggestive of significant self-perceived hearing handicap. Psychometric properties of this scale have been documented and have shown that the HHIE-S is a good measure of

self-perceived hearing handicap (Cronbach's $\alpha = .87$; test-retest reliability .96). A copy of the HHIE-S record form used in the study can be found in the Appendix.

Finally, a checklist of the top ten chronic conditions effecting older adults in the United States of America in 1994, produced by the National Center for Health Statistics (1995), was completed with each participant. Each chronic condition was individually read out loud to the participants. The participants answered "yes" or "no" depending on whether they had the condition or not. The researcher put a checkmark next to the condition for which the participant responded yes and left it blank if the participant responded no. If a participant was uncertain about a condition, it was described in layman's terms. A copy of the chronic health conditions checklist can be seen in Figure 2-1 below.

1.	<input type="checkbox"/>	Arthritis
2.	<input type="checkbox"/>	Hypertension
3.	<input type="checkbox"/>	Hearing Impairment
4.	<input type="checkbox"/>	Heart Disease
5.	<input type="checkbox"/>	Sinusitis
6.	<input type="checkbox"/>	Orthopedic Impairment
7.	<input type="checkbox"/>	Cataracts
8.	<input type="checkbox"/>	Diabetes
9.	<input type="checkbox"/>	Visual Impairments
10.	<input type="checkbox"/>	Tinnitus

Figure 2-1: Top ten chronic health conditions checklist used in the study. Adapted from the 1994 list produced by the National Center for Health Statistics (1995)

For the pure tone screening portion of the study, the following procedures were conducted. Otoloscopic examinations were performed prior to the pure tone screening using either an AudioScope3™ (Welch Allyn, Inc., Skaneateles Falls, NY) and/or an otoscope. The level of cerumen in each ear was subjectively judged by the researcher and

was recorded on a 4-point Likert scale of clear, minimal, fair amount, or occluded. Pure tone screenings were completed using an AudioScope3TM with pure tones of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz presented at 25 dB HL in each ear. Participants were instructed to raise their hands for each pure tone they heard. The intensity was raised to 40 dB HL if the participant did not respond to 25 dB HL at any frequency in either ear. Depending on the results of the otoscopic examination, pure tone hearing screening, and/or HHIE-S total score, follow-up recommendations were made. Recommendations made to each participant included any or all of the following: repeat hearing screening in one year, or sooner if a change is noticed, full audiologic examination, tinnitus evaluation, medical evaluation of suspected ear pathology, cerumen management, and hearing aid evaluation. Later in the study, a recommendation form was made and completed for each participant. A copy of this form can be seen in the Appendix. Participants were also given a list of local audiology clinics from which they could seek services if they so desired. This list was compiled based on the Find an Audiologist page on the American Academy of Audiology website and from the local telephone book listings. A copy of the referral lists can also be seen in the Appendix. Finally, most participants were given a brochure developed by the American Academy of Audiology (2003) entitled *What is an Audiologist?* as seen in Figure 2-2 below.

Study Participants

A total of 95 community-dwelling older individuals sought to participate in the study. Of the 95 older individuals who consented to participate in the study, four did not complete the study protocol. Three individuals did not meet the study requirements. Of these three individuals, two were prior hearing aid users and one was considerably



Figure 2-2: Picture of the front page of the *What is an Audiologist?* brochure produced by the American Academy of Audiology (2003)

younger than 65 years of age. Lastly, one individual declined further participation in the study for reasons unknown and undisclosed to the researcher. Therefore, 95.8% of individuals who consented to participate in the study qualified and completed the study protocol.

Ninety-one community-dwelling individuals, 64 females and 27 males, completed the study. The mean age of participants was 75.5 ($SD = 6.9$) years.

Research Hypotheses

The aforementioned study design allowed for the following null hypotheses to be made. “Yes respondents” below refer to the individuals who responded yes to the self-report question, “Do you think you have a hearing loss?” and the “no respondents” refer to the individuals who responded no to the same self-report question.

1. Participants’ acknowledgement responses (yes or no) to the self-report question were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, HHIE-S scores (e.g., total, emotional, and social), and gender.
2. Participants’ pure tone screening results (pass or fail) were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, HHIE-S scores (e.g., total, emotional, and social), and gender.
3. Self-perceived hearing handicap results (pass or fail) were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, and gender.
4. Age, gender, self-perceived hearing handicap, overall health perception rating, number of chronic health conditions, and defined hearing loss were not significant predictors of self-reported hearing loss.

Statistical Methods

The following section describes the statistical analyses that were conducted to test the study hypotheses. In addition, counter-balancing procedure of the presentation order of the study procedure will also be described.

Counter-Balanced Presentation Order

The presentation order for each part of the study (e.g., hearing screening and question parts) was counter-balanced for each participant. Before data collection began, a coin was tossed to determine if the hearing screening or the question part of the study would be administered first to the first. The questions were the first section to be administered to participant number one. The record data sheets were alternately labeled

to notify the researchers of the presentation order thereafter. A preliminary hypothesis stated that there were no significant differences in the study factors for those who received the hearing screening portion of the study first compared to those who received the question part of the study first. This hypothesis was later tested.

Statistical Analysis

Descriptive statistics included the mean, standard deviation, minimum, maximum, frequency, and sample size of many of the variables assessed in this study. Tests of significant differences between means (*t*-tests) were conducted to determine differences in age, overall perceived health rating, and number of chronic health conditions as a function of self-reported hearing loss, gender, and pass/fail criteria. Because conducting multiple independent *t*-tests increases the chance of Type I errors when interpreting them using a common alpha of .05, an a priori decision was made to determine which independent *t*-tests would be conducted to avoid this problem. The independent *t*-tests that were decided upon included, (1) *yes respondents* and *no respondents*, (2) gender, and three screening criteria based on (3) Ventry and Weinstein pure tone screening criteria (1983), (4) Dancer and Jackson (1996), and (5) HHIE >10 (Ventry & Weinstein, 1983). Because there were five *t*-tests conducted, the interpretation of these *t*-tests were made using a corrected Bonferroni's $\alpha = .01$ (original alpha divided by the number of *t*-tests) to ensure that statements regarding significance would not be made using an inflated alpha. The corrected alpha of .01 ensures that the overall risk for chance findings remains at a .05 level. Although the corrected alpha protects the research from making false claims regarding significant differences, it does increase the chance of Type II errors, or findings that are interpreted as not significant when they are (Perneger, 1998). However, the decision was made to use the corrected Bonferroni's alpha so as to avoid making false

statements of significant findings. Post-hoc *t*-tests were conducted on findings that warranted further investigation and that were not part of the original research hypotheses, but these were conducted at an α of .05.

Tests of association (Chi-Squared and/or Fisher's Exact Test) were conducted to determine the relationships among individually reported chronic health conditions, self-reported hearing loss, various operational screening criteria, gender, and age.

Step-wise binary logistic regression testing was undertaken to determine whether self-reported hearing loss could be predicted by the factors in the study. These predictive factors included age, gender, defined hearing loss, self-perceived hearing handicap, overall health perception, and number of chronic health conditions. All statistical analyses were accomplished by using the Statistical Package for the Social Sciences (version 11.5).

The performance of the self-report question was evaluated against various screening criteria as potential gold standards, although this evaluation was not the main focus of the study. Sensitivity, specificity, positive predictive value and negative predictive value (i.e., performance measures) were assessed for the self-report question when using different screening criteria as the gold standard. Performance measures of the self-report question were conducted against the three main criteria used in the study: Ventry and Weinstein pure tone screening criteria (1983), Dancer and Jackson (1996), and HHIE >10 (Ventry & Weinstein, 1983). In addition, the performance of the self-report question was assessed when using an ASHA pure tone screening criterion (1997) and HHIE >8 screening criterion (ASHA, 1997) as the gold standards. The later two criteria were only used for the purposes of conducting performance measures of the self-

report question and not for any other purposes in the study (i.e., no independent *t*-tests assess the factors in the study involved these two screening criteria).

Sensitivity, or the proportion of participants with hearing loss who correctly tested positive on the question (i.e., responded yes), was assessed using the formula, $TP/(TP + FN)$, where TP stands for true positive and FN stands for false negative. Specificity, or the proportion of participants without hearing loss who correctly tested negative (i.e., responded no), was calculated using the formula, $TN/(TN + FP)$, where TN stands for true negative and FP stands for false positive. Positive predictive value refers to the proportion of participants who have hearing loss out of those who tested positive and was calculated with the formula, $TP/(TP + FP)$. Finally, negative predictive value, or the proportion of participants with negative results who do not have hearing loss out of all with negative test results was assessed with the formula, $TN/(TN + FN)$ (Kenworthy, 1987). The following chapter unveils the results from the statistical analyses.

CHAPTER 3

RESULTS

This study was designed to determine the relationship between older individuals' acknowledgement of hearing loss and factors such as gender, age, and health. Participants responded to a series of questions related to their hearing and health and to a pure tone hearing screening battery. The measurements obtained from the study protocol allowed for analyses assessing differences and associations among several factors.

In this section, a general description of the sampled is provided. In addition, the independent *t*-test and Pearson Chi-Square test results evaluating the factors affecting acknowledgement and screening criteria will be reported. Specific to the screening criteria, results from Ventry and Weinstein (1983), Dancer and Jackson (1996), and HHIE-S >10 (Ventry & Weinstein, 1983) screening criteria will be reported in detail. In addition, this section describes the sample characteristics for the ASHA pure tone screening criterion and the HHIE-S >8 criterion (ASHA, 1997). Finally, step-wise binary logistic regression results for the factors that predict self-reported hearing loss will be unveiled.

General Description of Factors

General information on sample size, participant age, participant gender, self-reported hearing loss, self-perceived hearing handicap, five hearing screening criteria, overall health perception ratings, and number of chronic health conditions is described here.

Participants

Ninety-five older individuals consented to participate in the study. Four of these individuals did not complete the study protocol. The remaining 91 older adults who consented to participate in the study, nearly 96%, qualified for and completed the entire study protocol.

Age

The mean age of participants was 75.5 years ($SD = 6.9$). The age of the participants ranged from 64 years to 93 years. Even though one participant was 64 years of age, he was included in the study and in the analyses because he was only days away from his 65th birthday. The distribution of age across participants can be seen in Figure 3-1.

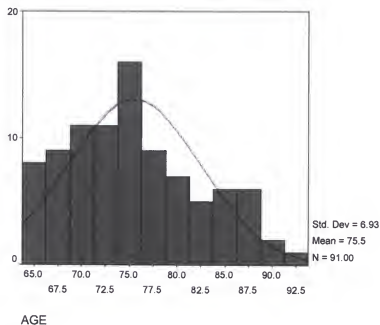


Figure 3-1: The age (in years) distribution of all participants in the study

Gender

Of the 91 participants, 27 were male and 64 were female. Male participants comprised 29.7% of the total study sample and female participants made up 70.3% of the study sample. The mean age of the male participants was 75.2 years ($SD = 6.0$) and the mean age of the female participants was 75.6 years ($SD = 7.3$). The difference between the mean ages of male and female participants was not significant at the corrected .01 level, $t(89) = -.29$, two-tailed, $p = .77$.

Self-Reported Hearing Loss

Participants responded to the self-report question “Do you think you have a hearing loss?” with a yes-no, forced-choice response. Participants who responded “yes” to the self-report question were labeled as “yes respondents.” Likewise, participants who responded “no” to the self-report question were labeled “no respondents.” All 91 participants responded to the self-report question. Fifty-six (61.5% of the study sample) participants responded yes and 35 (38.5% of the study sample) participants responded no to the question.

Self-Perceived Hearing Handicap

Self-perception of hearing handicap was assessed via the Hearing Handicap Inventory for the Elderly-Screening version (HHIE-S) developed by Ventry and Weinstein (1983). The mean HHIE-S emotional subscale score for all participants was 2.8 ($SD = 4.0$) with a range from 0 to 16. The mean HHIE-S social subscale score for all participants was 4.9 ($SD = 4.7$), ranging from a minimum score of 0 to a maximum score of 20. For all participants, the mean HHIE-S total score was 7.7 ($SD = 7.8$), ranging from 0-30.

Overall Health Perception Rating

Participants rated their overall health perception with a 5-point Likert scale ranging from excellent to very poor. Responses were coded as the following: (1) excellent, (2) good, (3) fair, (4) poor, and (5) very poor for 88 participants. Three participants did not rate their overall health perception. The mean overall health perception rating response by participants ($n = 88$) was 1.94 ($SD = .63$) with a range from 1 to 4.

Chronic Health Conditions

Self-reported chronic health conditions were assessed using a top-ten checklist (National Center for Health Statistics, 1995). The total number of chronic health conditions reported by the participants was recorded. The presence and absence of each condition was also recorded. For all participants, the mean number of chronic health conditions reported was 3.1 ($SD = 1.8$). The minimum number of chronic health conditions reported was 0 and the maximum number was 8 chronic health conditions.

Because hearing impairment was the third chronic health condition on the checklist, the number of chronic health conditions was also analyzed for all participants ($N = 91$), excluding hearing impairment. This exclusion allowed for a determination of whether there were discrepancies in participants' answers for the self-report question regarding hearing loss and the hearing impairment condition item on the checklist. The mean number of chronic health conditions reported when "hearing impairment" was excluded from the scoring of the checklist was 2.7 ($SD = 1.7$). The minimum number of chronic health conditions was 0 and the maximum was 7, when "hearing impairment" was excluded from the chronic health conditions checklist. A summary table (see Table 3-1) of the descriptive statistics for the factors in the study can be seen below.

Table 3-1: Summary of descriptive statistics for factors in the study

	N	Minimum	Maximum	Mean	Standard deviation
Age	91	64	93	75.47	6.93
HHIE-S (total)	91	0	30	7.69	7.81
HHIE-S (emotional)	91	0	16	2.77	4.02
HHIE-S (social)	91	0	20	4.92	4.74
Overall health perception rating	88	1	4	1.94	.63
No. of chronic conditions	91	0	8	3.10	1.84
No. of chronic conditions excluding hearing impairment	91	0	7	2.67	1.67

Screening Criteria

Several different criteria have been suggested when screening the hearing of older individuals (Yueh et al., 2003). These include pure tone screening criteria and self-perceived hearing handicap screening criteria. Five of these will be discussed below.

American Speech-Language-Hearing Association

The American Speech-Language-Hearing Association (ASHA) has recommended a pure tone screening criterion as outlined by ASHA's *Guidelines for Audiologic Screening* (1997). According to the ASHA guidelines, an adult, regardless of age, will be held to the same criterion for pure tone screenings. To pass this pure tone screening criterion, an adult must respond to a 25 dB HL pure tone administered at 1000 Hz, 2000 Hz, and 4000 Hz, when presented to both ears separately. If the individual fails to respond to any frequency in either ear, then that person fails the screening and a referral is made for a follow-up hearing evaluation.

In the present study, when the ASHA pure tone screening criterion was used as the gold standard, only 3 participants passed, resulting in a failure for 88 participants.

Pass/fail results for the number of participants as a function of self-reported hearing loss can be seen in Table 3-2. Also seen in Table 3-2 are cells for true positive responses (TP), false positive responses (FP), false negative responses (FN), and true negative responses (TN).

Table 3-2: ASHA pure tone screening results as a function of response to the self-report question

ASHA criterion	Response to self-report question		Total
	Yes	No	
Fail screening	55 (TP)	33 (FN)	88
Pass screening	1 (FP)	2 (TN)	3
Total	56	35	91

Ventry & Weinstein and Lichtenstein, Bess, & Logan

The pure tone screening criterion used by Ventry and Weinstein (1983) for screening older adults' hearing is the same one used by Lichtenstein et al. (1988a). For this criterion, a 40 dB HL pure tone is presented at 1000 Hz and 2000 Hz to each ear separately. Failure to respond to a 40 dB HL tone at 1000 Hz or 2000 Hz in both ears or 1000 Hz and 2000 Hz in one ear constitutes a failure.

When this criterion was used, 68 participants passed and 23 participants failed the hearing screening. Nineteen participants who failed the screening were *yes respondents* and 4 participants who failed the screening were *no respondents*. Of the 68 participants who passed the hearing screening, 37 were *yes respondents* and 31 were *no respondents*. A summary of the pass/fail results based on this criterion as a function of self-reported hearing loss can be found in Table 3-3.

Dancer & Jackson (1996)

The pure tone criterion used by Dancer and Jackson (1996) to screen the hearing of older adults was the most liberal of all the screening criteria used in this study. The

Table 3-3: Ventry and Weinstein (1983) and Lichtenstein et al. (1988a) pure tone screening results as a function of response to the self-report question

Ventry and Weinstein (1983) and Lichtenstein, Bess, and Logan (1988a) criterion	Response to self-report question		Total
	Yes	No	
Fail screening	19 (TP)	4 (FN)	23
Pass screening	37 (FP)	31 (TN)	68
Total	56	35	91

pass/fail criterion set by these authors was a 40 dB HL at 2000 Hz cut-off. If an individual responds to a 40 dB HL pure tone at 2000 Hz in each ear, a passing result is given. If an individual fails to respond to a 40 dB HL pure tone at 2000 Hz in one ear, or in both ears, a failing result is given and a referral is made for a follow-up hearing evaluation. Using this criterion, 21 *yes respondents* failed the hearing screening and 35 passed the hearing screening. In addition, 5 *no respondents* failed the hearing screening and 30 *no respondents* passed. A summary of these results can be found in Table 3-4.

Table 3-4: Dancer and Jackson (1996) pure tone screening results as a function of response to the self-report question

Dancer and Jackson (1996) criterion	Response to self-report question		Total
	Yes	No	
Fail screening	21 (TP)	5 (FN)	26
Pass screening	35 (FP)	30 (TN)	65
Total	56	35	91

Hearing Handicap Inventory for the Elderly (Screening Version)

The HHIE-S has been used as a tool to screen the hearing of older individuals (Lichtenstein et al., 1988b; McBride et al., 1994; Mulrow et al., 1990; Ventry & Weinstein, 1983). Rather than focusing on physiologic hearing loss, the HHIE-S assesses functional hearing loss. Various cut-off scores have been recommended when using the HHIE-S as a hearing screening tool. Ventry and Weinstein (1983) recommended a

referral, or failure, for an individual with a total score greater than 10. The cut-off score recommended by ASHA is a score of 8. Older individuals who have a total score of more than 8 on the HHIE-S fail the screening according to ASHA's *Guidelines for Audiologic Screening* (1997). Both of these HHIE-S screening criteria were used as a standard to which participants' responses to the self-report question were compared.

For the ASHA HHIE-S criterion with a cut-off score of 8 (or HHIE-S >8), 29 participants failed the screening. Of these 29 failures, 26 participants were *yes respondents* and 3 were *no respondents*. Sixty-two participants passed the screening, 30 of whom were *yes respondents* and 32 were *no respondents*. A summary of these results can be seen in Table 3-5.

Table 3-5: HHIE-S >8 screening results as a function of response to the self-report question

HHIE-S >8	Response to self-report question		Total
	Yes	No	
Fail screening	26 (TP)	3 (FN)	29
Pass screening	30 (FP)	32 (TN)	62
Total	56	35	91

For the Ventry and Weinstein (1983) HHIE-S criterion with a cut-off score of 10 (or HHIE-S >10), 26 participants failed the screening. Of these 26 failures, 23 participants were *yes respondents* and 3 were *no respondents*. Sixty-five participants passed the screening, of whom 33 were *yes respondents* and 32 were *no respondents*. A summary of these results can be seen in Table 3-6.

Table 3-6: HHIE-S >10 screening results as a function of response to the self-report question

HHIE-S >10	Response to self-report question		Total
	Yes	No	
Fail screening	23 (TP)	3 (FN)	26
Pass screening	33 (FP)	32 (TN)	65
Total	56	35	91

The results of the self-report question, “Do you think you have a hearing loss?” were considered against the five screening criteria (i.e., 1. ASHA pure tone, 2. Ventry & Weinstein [1983] and Lichtenstein, Logan, & Bess [1988] pure tone, 3. Dancer & Jackson [1996] pure tone, 4. ASHA’s HHIE-S >8, and 5. Ventry and Weinstein’s HHIE-S >10). Each of the screening criteria was discussed above. Performance measures of sensitivity, specificity, positive predictive value, and negative predictive value of the self-report question will be assessed with each of the criteria. The formulae (Kenworthy, 1987) and operational definitions (Childrens-Mercy, 2003) used to assess the performance of the self-report question can be seen in Table 3-7.

Sensitivity, specificity, positive predictive value, and negative predictive value of the self-report question were measured for each of the five screening criteria just described. The results of these performance measurements are shown in Table 3-8.

Table 3-7: Formulae and operational definitions for assessing performance of the self-report question

	Formula	Operational definition
Sensitivity	$TP/(TP + FN)$	Probability that participants who fail a screening criterion will say yes to the self-report question
Specificity	$TN/(TN + FP)$	Probability that participants who pass the screening criterion will say no to the self-report question
Positive predictive value	$TP/(TP + FP)$	Probability that a participant has hearing loss, as indicated by a criterion, when restricted to yes respondents
Negative predictive value	$TN/(TN + FN)$	Probability that a participant has no hearing loss, as indicated by a criterion, when restricted to no respondents

General observation of the differences between the performance of the self-report question and the different criteria indicates that they appear to be similar except for the ASHA pure tone screening criterion. For this criterion, the self-report question appears to

have lower sensitivity, somewhat higher specificity, much higher positive predictive value, and much lower negative predictive value compared to all other screening criteria.

Table 3-8: Performance of the self-report question against each screening criteria

	Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)
Formula used	TP/(TP+FN)	TN/(TN + FP)	TP/ (TP+FP)	TN/(TN+FN)
ASHA	62.5	66.7	98.2	5.7
Ventry and Weinstein, and Lichtenstein, Bess, and Logan (1988)	82.6	45.6	33.9	88.6
Dancer and Jackson (1996)	80.8	46.2	37.5	85.7
HHIE-S >8	89.7	51.6	46.4	91.4
HHIE-S >10	88.5	49.2	41.1	91.4

Factors Affecting Acknowledgement

The research design used in this study allowed determination of study variables that might affect acknowledgement of hearing loss by older adults. Analyses of acknowledgement results between *yes respondents* and *no respondents* were compared as a function of participant age, participant gender, overall health perception rating, and number of chronic health conditions. All comparisons were made using a 95% confidence interval. Independent sample *t*-tests for equality of means were conducted to assess mean differences of factors using a corrected Bonferroni $\alpha = .01$. Equal variances were assumed for all comparisons. In addition, acknowledgment results were evaluated to determine whether a relationship exists between the factors of interest, and if so, to what extent. This was accomplished via non-parametric testing. The hypothesis tested to evaluate the aforementioned was as follows:

Participants' acknowledgement responses (yes or no) to the self-report question were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, HHIE-S scores (e.g., total, emotional, and social), and gender.

Significant differences were found between *yes respondents* and *no respondents* for mean HHIE-S scores, including emotional subscale scores, social subscale scores, and total scores. The mean HHIE-S scores were higher (and thus more hearing handicap was evident) for the *yes respondents*. Significant differences were also found between *yes respondents* and *no respondents* for the number of chronic health conditions when hearing impairment was included as part of the checklist, but not when excluding hearing impairment from the chronic health conditions checklist. No significant differences were found for the mean age or mean overall perceived health rating between *yes respondents* and *no respondents*. The means of these factors between *yes respondents* and *no respondents* can be seen in Table 3-9. A summary of the independent *t*-tests results comparing *yes respondents* and *no respondents* as a function of age, self-perceived hearing handicap, and health variables can be found in Table 3-10.

Further analyses were conducted to determine to what extent the study factors (i.e., age, gender, and etc.) may be associated with acknowledgement of hearing loss. The following analyses were conducted to determine whether these relationships exist and to what extent.

Age

To examine further whether age was a factor in a participants' responses to the self-report question, three age groups were established, youngest (<75 years), middle (75 - 85 years), and eldest (≥ 85 years). Pearson Chi-Square test for association revealed no

Table 3-9: Age, handicap perception, and health factor means for yes and no respondents

	Self-reported hearing loss	N	Mean	Standard deviation	Standard error mean
Age	Yes	56	75.23	6.83	.91
	No	35	75.86	7.17	1.21
HHIE-S (emotional)	Yes	56	4.11	4.47	.60
	No	35	.63	1.66	.28
HHIE-S (social)	Yes	56	6.61	4.50	.60
	No	35	2.23	3.81	.64
HHIE-S (total)	Yes	56	10.71	7.61	1.02
	No	35	2.86	5.36	.91
Overall health perception rating	Yes	55	2.04	.69	.09
	No	33	1.79	.48	.08
No. of chronic health conditions	Yes	56	3.55	1.79	.24
	No	35	2.37	1.70	.29
No. of chronic conditions excluding hearing impairment	Yes	56	2.86	1.65	.22
	No	35	2.37	1.70	.29

Table 3-10: T-Tests results for age, handicap perception, and health factor means for yes and no respondents

T-Test for equality of means						
	t	df	Significance (2-tailed)	Standard error	95% confidence interval of the difference	
					Lower	Upper
Age	-.42	89	.68	1.50	-3.61	2.36
HHIE-S (emotional)	4.41	89	.00	.79	1.91	5.05
HHIE-S (social)	4.78	89	.00	.92	2.56	6.20
HHIE-S (total)	5.33	89	.00	1.47	4.93	10.79
Overall health perception rating	1.81	86	.07	.14	-.02	.52
No. of chronic health conditions	3.13	89	.00	.38	.43	1.93
No. of chronic conditions excluding hearing impairment	1.35	89	.18	.36	-.23	1.20

significant association between age and self-reported hearing loss, $\chi^2(2, N = 91) = .616, p = .74$. This may be due to the small number of very old participants in the sample.

Because no association was found for self-reported hearing loss and age using three age groups, the analysis was conducted again by dividing the participants into two main age groups that were labeled young-old (<75 years) and old-old (≥ 75 years). Pearson Chi-Square test for association was conducted, however, there was still no association between self-reported hearing loss and age, $\chi^2(1, N = 91) = .049, p = .642$. Any future analysis comparing age groups will do so only with the young-old and old-old age groups.

Gender

To determine whether there was an association between self-reported hearing loss and gender of participant, a Pearson Chi-Square analysis was completed. Results indicated that there was not a significant association between gender of participant and self-reported hearing loss, $\chi^2(1, N = 91) = .427, p = .51$.

Chronic Health Conditions

Chi-Square tests and/or Fisher's Exact test were conducted for each of the chronic health conditions on the top ten chronic health conditions checklist used in the study. There was not a significant association between self-reported hearing loss and arthritis, hypertension, heart disease, orthopedic impairment, cataracts, diabetes, visual impairment, and tinnitus. Fisher's Exact test revealed a significant association between self-reported hearing loss and sinusitis ($p = .03$, two-tailed). *Yes respondents* were approximately three times more likely to report sinusitis than *no respondents*.

Fisher's Exact test revealed a significant association between self-reported hearing loss (as measured by the question "Do you think you have a hearing loss?") and self-

reported hearing impairment on the chronic health conditions checklist, where $p = .00$ on a two-tailed test. *Yes respondents* were more likely to report hearing impairment than *no respondents*. In fact, 0% of *no respondents* reported hearing impairment and 100% of *no respondents* denied hearing impairment. In addition, *yes respondents* reported hearing impairment 69.6% of the time, while 30.3% of *yes respondents* denied hearing impairment.

Examination of Participants with Discrepant Responses

Recall that the self-report question in the study asked participants if they had a “hearing loss.” The term “hearing impairment” was on the top ten chronic health conditions checklist, embedded in a list of other chronic health conditions. Therefore, participants were asked to respond about hearing loss (i.e., “Do you think you have a hearing loss?”) and “hearing impairment.” However, some participants responded yes to the self-report question (i.e., *yes respondents*) and no to the hearing impairment item on the chronic health conditions checklist. These participants showed a discrepancy in their responses. On the other hand, some *yes respondents* reported hearing impairment and some *no respondents* denied hearing impairment, showing no discrepancy in their responses. Because this finding was unexpected, it warranted further analyses. These analyses will be discussed below. Because hearing impairment was part of the chronic health conditions checklist and separate analyses are being conducted for that specific item, any future analysis of the chronic health conditions checklist excludes hearing impairment.

Post-hoc independent *t*-tests were conducted to determine whether participants who showed a discrepancy were significantly different from those who did not report a discrepant response as a function of age, self-perceived hearing handicap, overall health

perception rating, and number of chronic health conditions checklist. This series of *t*-test results were not conducted with the corrected Bonferroni's alpha as the decision to perform this test was not made a priori. Instead, an α of .05 was used.

There were no significant differences between the participants who showed a discrepancy and those who did not as a function of age, self-perceived hearing handicap (all three HHIE-S scores), or health factors. Table 3-11 shows the results of the *t*-test.

Table 3-11: *T*-Test results for age, self-perceived hearing handicap, and health factors between participants who showed a discrepancy and participants who did not show a discrepancy

	<i>T</i> -Test for equality of means					
	<i>t</i>	df	Significance (2-tailed)	Standard error	95% confidence interval of the difference	
					Lower	Upper
Age	-1.41	89	.16	1.85	-6.2	1.08
HHIE-S	-1.70	89	.09	1.07	-3.94	.32
(emotional)						
HHIE-S (social)	-.55	89	.59	1.28	-3.24	1.85
HHIE-S (total)	-1.20	89	.23	2.10	-6.68	1.66
Overall health perception rating	-1.30	86	.20	.17	-.57	.12
No. of chronic health conditions	-.70	89	.48	.45	-1.22	.58

Age

Categorical variables such as age groups and gender were also evaluated in relation to discrepant reports concerning hearing loss. Fisher's Exact test was significant ($p = .00$, two-tailed) when evaluating an association between self-reported hearing loss and self-reported hearing impairment for each age group, young-old (<75 years) and old-old (≥ 75 years). See Figure 3-2 and Figure 3-3 for the number of young-old and old-old participants, respectively, as a function of self-reported hearing loss and self-reported

hearing impairment. For the young-old age group, *yes respondents* were more likely to report hearing impairment than *no respondents*, but 40% of young-old *yes respondents* denied hearing impairment. This was also the finding for old-old *yes respondents*, but only 16% of old-old *yes respondents* denied hearing impairment. Therefore, there seems to be an association within each young-old and old-old age group in that participants who reported hearing loss were more likely to also report hearing impairment.

When evaluating an association between showing a discrepancy and young-old or old-old age group, a significant association was not found. Pearson Chi-Square results indicated no significant relationship between age group and showing a discrepancy, $\chi^2(1, N = 91) = 3.00, p = .08$. In other words, relatively old-old participants were not more likely to show a discrepancy than relatively young-old participants, and vice versa.

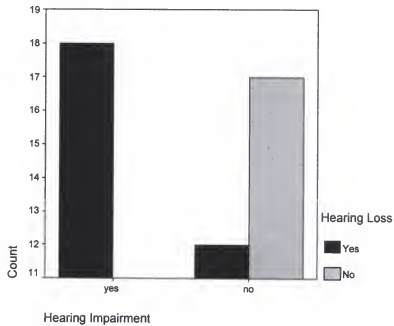


Figure 3-2: Number of *yes respondents* and *no respondents* in the young-old group and their report of hearing impairment on the chronic health conditions checklist

Gender

Self-reported hearing loss and self-reported hearing impairment were compared also as a function of participant gender using the Fisher's Exact test. Results indicated a significant association for both male ($p = .000$, two-tailed) and for female ($p = .001$, two-tailed) participants. Participants who responded yes to the self-report question were more likely to also report hearing impairment on the chronic health conditions checklist. This was true for both male and female participants.

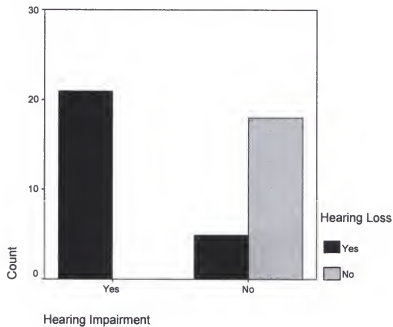


Figure 3-3: Number of *yes* respondents and *no* respondents in the old-old group and their report of hearing impairment on the chronic health conditions checklist

On the other hand, 33% of male *yes* respondents and 27% of female *yes* respondents denied hearing impairment on the checklist. Pearson Chi-Square test, when evaluating an association between gender of participant and a discrepant report, revealed no significant association. In other words, males were no more likely to show a discrepancy than were females, and vice versa. Figure 3-4 displays the number of male

participants as a function of self-reported hearing loss and self-reported hearing impairment and Figure 3-5 displays the same for female participants.

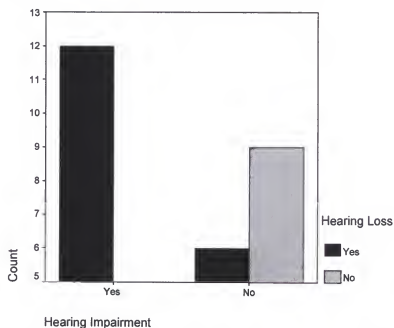


Figure 3-4: Number of male *yes* respondents and *no* respondents and their report of hearing impairment on the chronic health conditions checklist

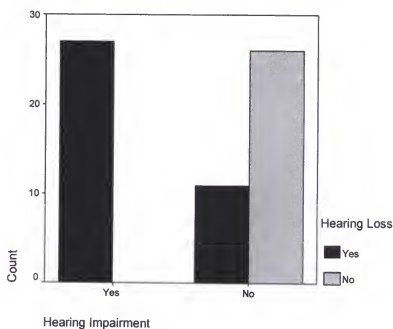


Figure 3-5: Number of female *yes* respondents and *no* respondents and their report of hearing impairment on the chronic health conditions checklist

Among Yes Respondents Only

Additional analyses were carried out to examine possible differences between *yes respondents* with discrepant responses and *yes respondents* with non-discrepant responses ($n = 56$). This was conducted to determine if factors such as age, gender, self-perceived hearing handicap, and health factors might help explain how these two groups differed.

Post-hoc independent *t*-tests revealed significant differences ($\alpha = .05$) for all three HHIE-S scores and for overall health perception rating, but not for total number of chronic health conditions. Participants reporting hearing loss and hearing impairment had significantly worse self-perceived hearing handicap (measured on all three HHIE-S scales) than participants who reported hearing loss, but not hearing impairment. In addition, participants who reported hearing loss and hearing impairment had a significantly worse overall health perception rating than did participants who reported hearing loss, but not hearing impairment. A summary of these findings can be found in Table 3-12 and Table 3-13.

Pearson Chi-Square results revealed no significant association between age groups and participants' assignment to discrepant or non-discrepant response groups $\chi^2(1, n = 56) = 2.84, p = .09$. In addition, a Pearson Chi-Square test was conducted to determine if there was an association between showing a discrepancy and gender. However, no significant association was found between gender and showing a discrepancy, $\chi^2(1, n = 56) = .00, p = .74$.

Table 3-12: Summary of mean self-perceived hearing handicap and health variables between *yes respondents* reporting hearing impairment and *yes respondents* not reporting hearing impairment

	Hearing Impairment	N	Mean	Standard deviation	Standard error mean
Age	Yes	39	73.35	7.04	1.17
	No	17	76.05	6.67	1.07
HHIE-S (emotional)	Yes	39	5.33	4.75	.76
	No	17	1.29	1.72	.42
HHIE-S (social)	Yes	39	7.59	4.38	.70
	No	17	4.35	4.01	.97
HHIE-S (total)	Yes	39	12.92	7.55	1.21
	No	17	5.65	4.96	1.20
Overall health perception rating	Yes	38	2.16	.72	.12
	No	17	1.76	.56	.14
No. of chronic conditions	Yes	39	3.05	1.69	.27
	No	17	2.42	1.50	.36

Table 3-13: *T*-Tests comparing self-perceived hearing handicap and health variables between *yes respondents* reporting hearing impairment and *yes respondents* not reporting hearing impairment

	T-Test for equality of means					
	t	df	Significance (2-tailed)	Standard error difference	95% confidence interval of the difference	
					Lower	Upper
Age	1.37	54	.18	1.97	-6.65	1.25
HHIE-S (emotional)	3.39	54	.00	4.04	1.19	1.65
HHIE-S (social)	2.61	54	.01	3.24	1.24	.75
HHIE-S (total)	3.64	54	.00	7.28	2.00	3.26
Overall health perception rating	2.0	53	.05	.39	.20	-.02
No. of Chronic Conditions	1.38	54	.18	.64	.48	-.31

Excluding Participants with Discrepant Responses

Finally, additional analyses were conducted between *yes respondents* and *no respondents* when excluding all participants who showed a discrepancy ($n = 74$). A comparison between age, gender, self-perceived hearing handicap, and health factors was

made. Results indicated that there were significant differences between *yes respondents* and *no respondents* for all three HHIE-S scores and overall health perception rating, but not for age or number of chronic health conditions. In other words, when excluding participants who showed a discrepancy, *yes respondents* had significantly more self-perceived hearing handicap than *no respondents*. In addition, non-discrepant *yes respondents* reported worse overall health perception ratings than *no respondents*. Table 3-14 shows the mean values for the factors compared between *yes respondents* and *no respondents* when excluding those who showed a discrepancy from the analysis. *T*-test results of this same comparison can be seen in Table 3-15.

Table 3-14: Means for age, self-perceived hearing handicap, and health factors for *yes respondents* and *no respondents* when excluding participants who showed a discrepancy between self-reported hearing loss and self-reported hearing impairment

	Hearing Impairment	N	Mean	Standard deviation	Standard error mean
Age	Yes	39	76.05	6.66	1.07
	No	35	75.86	7.17	1.21
HHIE-S (emotional)	Yes	39	5.33	4.75	.76
	No	35	.63	1.66	.28
HHIE-S (social)	Yes	39	7.59	4.38	.70
	No	35	2.23	3.81	.64
HHIE-S (total)	Yes	39	12.92	7.55	1.21
	No	35	2.86	5.36	.91
Overall health perception rating	Yes	39	2.16	.72	.12
	No	35	1.79	.48	.84
No. of chronic conditions	Yes	39	3.05	1.69	.27
	No	35	2.37	1.70	.29

Also, Pearson Chi-Square tests were conducted to determine whether an association existed between self-reported hearing loss and age, gender, or overall health perception rating when the participants who showed a discrepancy between self-reported hearing loss and self-reported hearing impairment were excluded from the analyses. No

Table 3-15: *T*-Tests comparing age, self-perceived hearing handicap, and health variables between *yes respondents* and *no respondents* when excluding participants who showed a discrepancy between self-reported hearing loss and self-reported hearing impairment

	<i>T</i> -Test for equality of means					
	t	df	Significance (2-tailed)	Standard error difference	95% confidence interval of the difference	
					Lower	Upper
Age	.121	72	.90	1.61	-4.06	4.45
HHIE-S (emotional)	5.55	72	.00	.85	2.46	6.95
HHIE-S (social)	5.59	72	.00	.96	2.82	7.90
HHIE-S (total)	6.54	72	.00	1.54	5.99	14.14
Overall health perception rating	2.51	69	.02	.15	-.02	.76
No. of chronic conditions	1.73	72	.09	.39	-.36	1.72

significant association was found for young-old and old-old age groups, $\chi^2(1, n = 74) = .04, p = .84$, gender, $\chi^2(1, n = 74) = .23, p = .63$, or overall health perception rating, $\chi^2(3, n = 71) = 6.87, p = .08$, among participants' responses to the self-report question, when excluding those participants who showed a discrepancy.

When comparing the *t*-test results for the study factors between all *yes respondents* and *no respondents* ($N = 91$) versus only non-discrepant *yes respondents* and *no respondents* ($n = 74$), the HHIE-S scores were significantly different for both analyses. In other words, self-perceived hearing handicap was significantly worse for *yes respondents* no matter if non-discrepant participants were included in the analyses or not. However, this was not the case for overall health perception rating. When including all participants in the analysis, there was not a significant difference in overall perceived health rating between *yes* and *no respondents*. However, when excluding the participants who showed a discrepancy, there was a significant difference between *yes respondents*

and *no respondents* for this factor in that *yes respondents* rated their overall health perception as poorer than *no respondents*.

Factors Affecting Pure Tone Screening Results

Results from two pure tone screening criteria as a function of participant age, overall health perception, and number of chronic health conditions were compared. All comparisons were made using a 95% confidence interval and a corrected Bonferroni's $\alpha = .01$. These two screening criteria were chosen to compare *a priori* as both represented a higher fence (i.e., 40 dB HL screening criteria as opposed to a 25 dB HL screening criteria), which is recommended when screening the hearing of older individuals (Weinstein, 2000). Independent sample *t*-tests for equality of means were conducted to assess mean differences between factors. Equal variances were assumed for all comparisons. In addition, results from each pure tone screening criteria were tested for association between age, gender, and overall health perception ratings using a Pearson Chi-Square test. These analyses will be described below. The hypothesis tested was as follows:

Participants' pure tone screening results (pass or fail) were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, HHIE-S scores (e.g., total, emotional, and social), and gender.

Ventry & Weinstein and Lichtenstein, Bess, & Logan

Participants who passed the hearing screening and those who failed based on the criterion proposed by Ventry and Weinstein (1983), as well as by Lichtenstein, Bess and Logan (1988a), were compared as a function of age, self-perceived hearing handicap, health measurements, and gender. Significant differences were found for all measures, except for the number of chronic health conditions, between participants who passed and participants who failed based on this criterion. Factor means can be found in Table 3-16.

Table 3-16: Age, handicap perception and health factor means for participants who passed or failed based on Ventry & Weinstein (1983) and Lichtenstein et al. (1988) pure tone screening criterion

Ventry and Weinstein (1983) Lichtenstein, Logan, and Bess (1988)		N	Mean	Standard deviation	Standard error mean
Age	Pass	68	74.16	6.47	.78
	Fail	23	79.35	6.95	1.45
HHIE-S (emotional)	Pass	68	2.15	3.68	.45
	Fail	23	4.61	4.49	.94
HHIE-S (social)	Pass	68	4.03	4.10	.50
	Fail	23	7.57	5.56	1.16
HHIE-S (total)	Pass	68	6.18	6.87	.83
	Fail	23	12.17	8.84	1.84
Overall health perception rating	Pass	66	1.85	.59	.07
	Fail	22	2.23	.69	.15
No. of chronic health conditions	Pass	68	2.52	1.59	.19
	Fail	23	3.13	1.87	.39

As seen in Table 3-16, the mean HHIE-S total score, HHIE-S emotional subscale score, and HHIE-S social subscale scores were significantly higher (i.e., worse) for participants who failed based on this pure tone screening criterion than for those who passed. The mean age of the participants who passed based on this criterion was significantly greater than for the participants who failed. In addition, participants who failed based on this criterion reported a higher (i.e., worse) overall health perception rating than did participants who passed. There was no significance in the mean number of chronic health conditions between participants who failed or passed. Independent sample *t*-tests were conducted to determine if the differences between the group means were significant at the corrected $\alpha = .01$ level. Table 3-17 displays the results of these analyses.

Pearson Chi-Square tests were conducted to determine if an association could be found between this criterion result and age group, gender, and self-reported hearing loss. Results indicated that whether a participant passed or failed this criterion was not

Table 3-17: *T*-Tests results age, handicap perception and health factor for participants who passed or failed based on Ventry & Weinstein (1983) and Lichtenstein et al. (1988a) pure tone screening criterion

	T-Test for equality of means					
	t	df	Significance (2-tailed)	Standard error difference	95% confidence interval of the difference	
					Lower	Upper
Age	-3.26	89	.00	1.59	-8.34	-2.03
HHIE-S (emotional)	-2.62	89	.01	.94	-4.66	-.59
HHIE-S (social)	-3.26	89	.00	1.09	-5.69	-1.38
HHIE-S (total)	-3.36	89	.00	1.79	-9.55	-2.45
Overall health perception rating	-2.51	86	.01	.15	-.68	-.08
No. of chronic health conditions	-1.54	89	.13	.40	-1.41	.18

dependent upon age when grouped as young-old or old-old, $\chi^2(1, N = 91) = 3.51, p = .06$ or gender of participant, $\chi^2(1, N = 91) = .01, p = .93$. However, there was a significant association between self-reported hearing loss and this screening criterion, $\chi^2(1, N = 91) = 5.78, p = .02$. This association was reported earlier in the results section as well.

Dancer & Jackson (1996)

Comparisons were made between participants who passed the Dancer and Jackson (1996) pure tone hearing screening criterion and participants who failed based on this criterion. These comparisons included health variables, age, and self-perceived hearing handicap as measured by the HHIE-S. Significant differences in measurement means between passing participants and failing participants were noted for age, self-perceived hearing handicap measures, the number of chronic health conditions but not for overall perceived health rating. The factor means can be found in Table 3-18. As with the previous screening criterion, the participants who failed had a significantly higher mean age than the participants who passed, $t(89) = -3.83$, two-tailed, $p = .00$. Significantly

higher, or worse, HHIE-S total scores, $t(89) = -3.38$, two-tailed, $p = .001$, HHIE-S emotional subscale scores, $t(89) = -3.14$, two-tailed, $p = .002$, and HHIE-S social subscale scores $t(89) = -2.85$, two-tailed, $p = .005$, were observed for those participants who failed than for those who passed. And finally, participants who failed the hearing screening reported more chronic health conditions, $t(89) = -2.66$, two-tailed, $p = .01$, than did those participants who passed. Mean health perception ratings were not significantly different, $t(86) = -2.06$, two-tailed, $p = .04$, between those who passed the screening with this criterion and those who failed with this criterion.

Table 3-18: Age, handicap perception and health factor means for participants who passed or failed based on Dancer & Jackson (1996) pure tone screening criterion

Dancer and Jackson (1996) pure tone screening criterion		N	Mean	Standard deviation	Standard error mean
Age	Pass	65	73.83	6.43	.80
	Fail	26	79.58	6.52	1.28
HHIE-S (emotional)	Pass	65	1.97	3.40	.42
	Fail	26	4.77	4.77	.94
HHIE-S (social)	Pass	65	4.06	4.06	.50
	Fail	26	7.08	5.64	1.11
HHIE-S (total)	Pass	65	6.03	6.57	.82
	Fail	26	11.85	9.17	1.80
Overall health perception rating	Pass	63	1.86	.59	.07
	Fail	25	2.16	.69	.14
No. of chronic conditions	Pass	65	2.46	1.58	.20
	Fail	26	3.19	1.81	.36

Pearson Chi-Square tests were conducted to determine whether there was an association between this criterion result and age, gender, and self-reported hearing loss. A significant association was found for age, when grouping age into either young-old or old-old groups. In addition, a significant association was found between self-reported hearing loss and this screening criterion result. There were no significant associations between Dancer and Jackson (1996) criterion results and gender of participant. A

summary of the Chi-Square findings for the Dancer and Jackson (1996) results can be found in Table 3-19.

Table 3-19: Chi-Square findings for Dancer and Jackson (1996)

Dancer and Jackson (1996)	Pearson Chi-Square value	df	N	Significance
Age group: young-old or old-old	6.35	1	91	.01
Gender	.02	1	91	.89
Self-Reported hearing loss	5.69	1	91	.02

Factors Affecting Hearing Handicap Results

Results from the self-perceived hearing handicap screening (i.e., HHIE-S >10) as a function of participant age, overall health perception, and number of specific chronic health conditions were evaluated. All analyses used a 95% confidence interval. Independent sample *t*-tests for equality of means were conducted to assess mean differences between factors. A corrected Bonferroni's $\alpha = .01$ was used when evaluating significance. Equal variances were assumed for all comparisons. The hypothesis tested was as follows:

Self-perceived hearing handicap results (pass versus fail) were not significantly different as a function of age, overall perceived health rating, number of chronic health conditions, and gender.

In addition, Pearson Chi-Square tests were conducted to assess associations between each HHIE-S >10 screening criteria results and age, gender, and self-reported hearing loss.

Comparisons of participants' self-perceived hearing handicap screening results as a function of age, overall perceived health rating, and number of chronic health conditions were made using one HHIE-S criterion for failing the handicap screening: a score greater than 10 was chosen to test a priori as this is the recommended criterion by

the HHIE-S authors (Ventry & Weinstein, 1983). Based on this criterion, participants were divided into those who passed and those who failed the hearing handicap screening.

Significant differences between participants who passed and failed the handicap screening were found for overall perceived health rating but not for the number of chronic health conditions. Participants who failed the screening with the HHIE-S >10 criterion reported significantly higher, or worse, mean overall health perception ratings than did those who passed using the HHIE-S >10 screening criteria. No significant differences were found for age or for the number of chronic health conditions. A summary of the independent *t*-test results for the HHIE-S >10 criterion can be found in Tables 3-20.

Table 3-20: *T*-test results for HHIE-S >10 self-perceived hearing handicap criterion

	<i>t</i>	df	T-Test for equality of means			
			Significance (2-tailed)	Standard error difference	95% confidence interval of the difference	
					Lower	Upper
Age	1.76	89	.86	1.62	-2.93	3.50
Overall health perception rating	-3.33	86	.00	.14	-.75	-.19
No. of chronic conditions	-2.21	89	.03	.38	-1.59	-.08

Pearson Chi-Square tests were conducted to determine if association between self-perceived hearing handicap criterion results (i.e., pass or fail HHIE-S >10) and age groups and gender.

Pearson Chi-Square test results were for the HHIE-S >10 criterion revealed no association between the results (i.e., pass or fail) and young-old versus old-old age groups and participant gender. However, an association between HHIE-S >10 results and self-

reported hearing loss occurred, as reported earlier. Pearson Chi-Square results for the HHIE-S >10 screening criterion can be found in Table 3-21.

Table 3-21: Chi-Square results for HHIE-S >10

HHIE-S >10	Pearson Chi-Square value	df	N	Significance
Age group: young-old or old-old	.04	1	91	.84
Gender	.76	1	91	.38
Self-reported hearing loss	11.15	1	91	.00

Presentation Order

There were two parts to this study, a pure tone hearing screening portion (i.e., otoscopy and Audioscope^{3™}) and a question portion (i.e., self-report question, HHIE, overall health perception rating, and top ten chronic health conditions checklist), the order of which was randomly assigned to the participants. Preliminary analyses were conducted to ensure that there were no significant differences in self-reported hearing loss, age, gender, self-perceived hearing handicap, or health factors for those who received the hearing screening portion of the study first compared to those who received the question part of the study first. Independent *t*-test results suggested no significant difference in age, HHIE-S scores, overall health perception rating, or number of chronic conditions as a function of presentation order. See Table 3-22 for means of these factors and Table 3-23 for results of the *t*-test. No significant association was found between presentation order and gender, $\chi^2(1, N = 91) = .12, p = .78$, self-reported hearing loss, $\chi^2(1, N = 91) = .40, p = .53$, or age group, $\chi^2(1, N = 91) = .11, p = .74$.

Factors Predicting Acknowledgement of Hearing Loss

Step-wise binary logistic regression analyses were conducted to determine whether any of the factors in the study predicted responses to the self-report question depending on the screening criteria used. These analyses were made by entering age, gender, overall

health perception rating, self-perceived hearing handicap, number of chronic conditions, and a hearing loss definition into the model. An alpha of .05 was used to determine significance.

Table 3-22: Age, self-perceived hearing handicap, and health factor means between participants who received the hearing screening portion of the study first compared to those who received the questionnaire portion of the study first

Order		N	Mean	Standard deviation	Standard error mean
Age	Hearing screening	43	75.86	7.62	1.16
	Questionnaire	48	75.13	6.31	.91
HHIE-S (emotional)	Hearing screening	43	2.98	4.24	.65
	Questionnaire	48	2.58	3.85	.56
HHIE-S (social)	Hearing screening	43	4.93	5.56	.85
	Questionnaire	48	4.92	3.91	.57
HHIE-S (total)	Hearing screening	43	7.91	8.64	1.32
	Questionnaire	48	7.50	7.08	1.02
Overall perceived health rating	Hearing screening	42	2.07	.68	.10
	Questionnaire	46	1.83	.57	.08
No. of chronic conditions	Hearing screening	43	2.49	1.67	.25
	Questionnaire	48	2.83	1.68	.24

Table 3-23: *T*-test results for participants who received the hearing screening test first compared to those who received the questionnaires first

<i>T</i>-Test equality of means						
	t	df	Significance (2-tailed)	Standard error difference	95% Confidence interval of the difference	
					Lower	Upper
Age	.50	89	.62	1.46	-2.17	3.64
HHIE-S (emotional)	.46	89	.64	.85	-1.29	2.08
HHIE-S (social)	.01	89	.99	1.00	-1.97	2.00
HHIE-S (total)	.25	89	.81	1.65	-2.87	3.68
Overall perceived health rating	1.85	86	.07	.13	-.02	.51
No. of chronic conditions	-.98	89	.33	.35	-1.04	.35

To ensure that multicollinearity was not a problem in the regression analyses, some additional tests were conducted. The extent to which one predictor variable in a regression model is highly correlated with another predictor variable may cause the standard error to become gravely inflated and impact the reliability of the logit coefficients (Garson, 2003). Therefore, correlations were performed between the HHIE-S emotional subscale and HHIE-S social subscale. Pearson bivariate correlations between the two subscales was significant ($p < .01$) and moderately-strong ($r = .59$), and one that resulted in a very large standard error when both subscales were included in the model. Therefore, only the total HHIE-S score was included in the model. In addition, Pearson bivariate correlation was conducted for overall health perception rating and for total number of chronic health conditions. This correlation was significant ($p < .01$), but weak ($r = .43$) and did not cause as large of a standard error as did the HHIE-S subscales. Therefore, both overall health perception rating and number of chronic health conditions were included in the regression model. The step-wise binary logistic regression model was conducted for each hearing loss definition of particular interest in the study (Ventry and Weinstein [1983], Dancer and Jackson [1996], and HHIE-S > 10). The interpretation of the binary regression is similar to the interpretation of a linear regression model.

Ventry and Weinstein (1983)

The binary logistic regression model suggested that HHIE-S total score was the only significant predictor of a participant reporting a hearing loss when using the Ventry and Weinstein (1983) criterion to define hearing loss. The regression model was significant $R^2 = .392$, $\chi^2 (6, N = 91) = 29.80$, $p = .00$. The factors that were evaluated as predictors of self-reported hearing loss and their significance levels can be seen in Table

3-24. These results suggest that the probability of reporting a hearing loss significantly increases as HHIE-S total scores increase.

Table 3-24: Binary logistic regression results for predictors of self-reported hearing loss using Ventry and Weinstein (1983) screening criterion

	B	SE	Wald	df	Significance	Expected (B)
HHIE-S	-.22	.06	11.74	1	.00	.81
Age	.03	.04	.43	1	.51	1.03
Gender	-.68	.60	1.28	1	.26	.51
Ventry and Weinstein (1983)	.73	.80	.83	1	.36	2.08
Overall health perception rating	-.36	.55	.44	1	.51	.70
No. chronic conditions	-.00	.19	.00	1	.99	1.00
Constant	-1.09	3.66	.09	1	.77	.34

Dancer and Jackson (1996)

The binary logistic regression model suggested that HHIE-S total score was the only significant predictor of a participant reporting a hearing loss when using the Dancer and Jackson (1996) criterion to define hearing loss. The regression was significant $R^2 = .394$, $\chi^2(6, N = 91) = 30.06$, $p = .00$. The factors that were evaluated as predictors of self-reported hearing loss and their significance levels can be seen in Table 3-25. As with the Ventry and Weinstein (1983) criterion, these results suggest that the probability of reporting a hearing loss significantly increases as HHIE-S total scores increase.

Self-Perceived Hearing Handicap Criterion

A binary logistic regression model was conducted when entering age, gender, HHIE-S total score, overall health perception rating, number of chronic health conditions, and the HHIE-S >10 definition of hearing loss. As with the previous two screening criteria, the HHIE-S total score was a predictor of self-reported hearing loss when using

Table 3-25: Binary logistic regression results for predictors of self-reported hearing loss using Dancer and Jackson (1996) screening criterion

	B	SE	Wald	df	Significance	Expected (B)
HHIE-S	-.22	.06	11.77	1	.00	.81
Age	.03	.05	.57	1	.45	1.03
Gender	-.67	.60	1.25	1	.26	.51
Dancer and Jackson (1996)	.80	.77	1.08	1	.30	2.22
Overall health perception rating	-.40	.54	.54	1	.46	.67
No. chronic conditions	-.01	.19	.00	1	.97	1.01
Constant	-1.48	3.75	.16	1	.69	.23

the HHIE-S >10 definition of hearing loss. In addition, the HHIE-S >10 screening criterion (i.e., whether one passed or failed) was a significant predictor of self-reported hearing loss. These results can be seen in Table 3-26. The regression was significant $R^2 = .44$, $\chi^2(6, N = 91) = 34.04$, $p = .00$. These results suggest that the probability of reporting a hearing loss significantly increases as HHIE-S total scores increase.

Table 3-26: Binary logistic regression results for predictors of self-reported hearing loss using HHIE-S >10 screening criterion

	B	SE	Wald	df	Significance	Expected (B)
HHIE-S	-.39	.10	14.33	1	.00	.68
Age	.02	.04	.20	1	.66	1.02
Gender	-.87	.63	1.88	1	.17	.42
HHIE >10	-2.95	1.34	4.87	1	.03	.05
Overall health perception rating	-.72	.57	1.57	1	.21	.49
No. chronic conditions	-.01	.20	.00	1	.97	1.01
Constant	-1.48	3.75	.16	1	.69	.23

Summary of Results

The primary purpose of this study was to evaluate the extent to which older adults acknowledge hearing loss and whether there may be an association between hearing loss

acknowledgement and health, age, and gender. Additional analyses were performed to further evaluate any interesting findings among the factors in the study. In summary, *yes respondents* reported more hearing handicap than *no respondents*, but did not report worse health ratings, higher number of chronic health conditions, or higher age. There were also no gender differences between *yes respondents* and *no respondents*.

Some *yes respondents* showed a discrepancy when reporting hearing loss and hearing impairment. They also reported less self-perceived hearing handicap and rated their overall health perception as better than *yes respondents* who did not show a discrepancy. No age or gender differences were noted. When all participants were included in the analyses, as mentioned earlier, only self-perceived hearing handicap was significantly different between *yes respondents* and *no respondents*.

Generally, participants who failed the pure tone screening criteria were older, reported more self-perceived hearing handicap, and rated their health as worse, compared to those participants who passed the pure tone screening criteria. For the HHIE-S >10 criterion, participants who failed were reportedly less healthy than the participants who passed. For all three screening criteria of particular interest in the study, there was an association between self-reported hearing loss and criteria results.

Finally, self-perceived hearing handicap was the main predictor of self-reported hearing loss as assessed via binary logistic regression analyses. However, self-reported hearing loss was not significantly predicted by age, gender, health factors, or pure tone hearing definitions. This finding suggests that the probability of a self-reported hearing loss increases as self-perceived hearing handicap increases. In the next chapter, interpretation of these results and findings will be discussed in detail.

CHAPTER 4 DISCUSSION

Senescent changes in hearing sensitivity can greatly impact the quality of life of older individuals (Administration on Aging, 2001; National Council on the Aging, 1999). The primary treatment recommended to alleviate any communicative and psychosocial consequences of hearing loss in older adults is typically regular hearing aid use (Holmes, 1995); however, there is a significantly low rate of hearing aid ownership by elderly persons with hearing loss (Jerger et al., 1995; Popelka et al., 1998). In addition, there is a high discontinuance rate of hearing aid use by elderly individuals who own hearing aids (Popelka et al., 1998). One of the reasons repeatedly postulated for both lack of hearing aid ownership and discontinuance of hearing aid use in older adults is hearing loss denial (Maurer, 1998; Rawool, 2000).

The current study evaluated acknowledgement of hearing loss by older adults who had no prior history of hearing aid use. Acknowledgement was assessed by a self-report question ("Do you think you have a hearing loss?") compared against five different screening criteria. In addition, participants answered questions related to chronic health conditions and an overall health perception rating to determine whether these health factors were associated with acknowledgement. Finally, factors such as age and gender were examined as potential factors associated with hearing loss acknowledgement. The findings of the current study were reported in the previous chapter. In this section, interpretation of those findings will be discussed.

Self-Reported Hearing Loss

In general, the majority of participants in the current study accurately reported hearing loss, or not, on the self-report question, “Do you think you have a hearing loss?” That is, those who responded yes to the self-report question had hearing loss and those who responded no to the self-report question did not have hearing loss, based on various screening criteria. Clark et al. (1991) and Dancer and Jackson (1996) had similar findings when using self-report questions with slightly different wording. They too found that older adults, when asked a self-report question, responded fairly accurately. In addition, they concluded that few older adults deny a hearing loss when a significant hearing loss was present, as was the finding in the current study. However, the current study aimed to determine whether other factors such as age, gender, and health, influenced hearing loss acknowledgement, which was not attempted in the two studies aforementioned.

If participants responded inaccurately to the self-report question in the current study, they generally responded yes to the self-report question and passed one of the hearing screening criteria. This finding suggests that older adults might be acknowledging a minimal hearing loss. It also may be that they are responding yes because they are experiencing auditory processing difficulties as these problems increase with age (Jerger et al., 1995; Stach et al., 1990).

Counter-Balanced Presentation Order

The self-report question was part of the question portion of the study. The presentation order of the study portions (i.e., questions or pure tone screening) was administered to the participants via a counter-balancing procedure. The concern was that if participants felt that they performed poorly on the hearing screening or thought that they failed the hearing screening, that these perceptions might influence their responses

to the self-report questions and questionnaires. To avoid this, the presentation order was counter-balanced. In fact, the results suggested that there were no differences in age, gender, self-reported hearing loss, self-perceived hearing handicap, or health factors as a function of presentation order. In other words, the participants were not significantly influenced by presentation order. There was a trend, however, suggesting that those who received the hearing screening first may have reported slightly lower overall perceived health. The effect of presentation order approached significance for this variable, probably because the hearing screening activated some general concerns about health.

Age

It has been suggested that there are age differences in self-reported hearing loss. Erdman and Demorest (1998) reported that older adults are more willing to admit hearing loss and hearing problems than are younger adults. This may be because older adults do not view hearing loss as stigmatizing compared to younger adults (Erler & Garstecki, 2002). In these studies, however, most comparisons are made between younger adults (i.e., 30 to 50 years old) and older adults 65+. The present study aimed to determine if there were age differences within a group of older adults. Therefore, one hypothesis in the current study was that *no respondents*, capturing those who may deny hearing loss, would be younger in age.

When assessing mean age across all participants, there were no significant differences for age as a function of self-reported hearing loss (i.e., yes or no response to the self-report question). To examine further whether age was a factor in self-reported hearing loss, participants were divided into youngest, middle, and eldest groups first, and then later divided into young-old and old-old age groups. However, results suggest that acknowledgement responses did not vary with age, regardless of how age groups were

defined. This finding may not have been significant possibly due to an inadequate sample size. There may not have been enough old-old participants in the study to make a meaningful comparison within a group of older adults.

Gender

Hearing loss acknowledgement may be different for men than for women (Garstecki and Erler, 1999). Héту et al. (1993) suggested that women are more likely to acknowledge hearing loss than are men. The present study aimed to determine whether hearing loss acknowledgment was different for older men and older women. However, no association was found between gender of participant and self-reported hearing loss. The current results may be different from those suggested by Garstecki and Erler (1999) due to the fact that the majority of the participants in the current study were women. It might be that gender differences exist, but that they could not be evaluated properly due to the comparatively small number of men in the current study. In addition, Garstecki and Erler (1999) found gender differences on the CPHI, a questionnaire evaluating communication problems. It may also be that gender differences are more apparent on a detailed questionnaire like the CPHI and not on a general self-report question like the one used in this study.

Self-Perceived Hearing Handicap

Self-perceived hearing handicap was assessed via a face-to-face administration of the HHIE-S (Ventry & Weinstein, 1983). It was thought that those who report hearing loss would also report hearing handicap, and to a greater degree than those who deny hearing loss. Results supported this premise in that *yes respondents* had significantly higher HHIE-S scores than *no respondents*. This finding supports the notion that people who are willing to acknowledge their hearing losses will report more emotional and

social problems related to hearing loss than people who are not aware of their hearing losses and/or who are unwilling to acknowledge hearing difficulties. It is not surprising that individuals who admit hearing losses may also be willing to admit self-perceived hearing handicap. Ventry and Weinstein (1983) reported that scores of 10 or more were suggestive of self-perceived hearing handicap. The mean total score of *yes respondents* was approximately 11, or a minimal hearing handicap, with *yes respondents* reporting more social than emotional consequences. As might be expected, *no respondents* did not report a significant self-perceived hearing handicap (average total score of approximately 3). Differences between mean HHIE-S total score were larger when participants who showed a discrepancy were removed from the analysis. Total HHIE-S score for *yes respondents* was 13 and 3 for *no respondents* for this analysis. This suggests that individuals who are willing to report hearing loss and hearing problems will also recognize significant psychosocial factors more than individuals who deny hearing loss and hearing problems.

Health

Participants in this study reported on their overall health perception rating using a 5-point Likert scale and completed a chronic health conditions checklist described earlier. Our supposition was that the *no respondents* might have poorer overall health perception than *yes respondents*. This hypothesis stemmed from the thought that older adults might be preoccupied with other chronic conditions that they view as more serious, and therefore, might not acknowledge hearing loss (Maurer, 1998).

There was a significant difference in overall health perception ratings between *yes respondents* and *no respondents*, but it was contrary to the hypothesis. In fact, *yes respondents* reported significantly poorer (i.e., higher value) overall health perception

ratings than did *no respondents*. It may be speculated that individuals who view themselves as being less healthy are more likely to report hearing loss, or that a relationship between health and hearing might exist (Bess et al., 1989; Pugh & Crandell, 2002). Whether hearing loss causes poorer health or if poorer health causes hearing loss has yet to be determined. It is also possible that individuals who are more open about their health conditions are going to be more open about any hearing problems they may be experiencing.

In addition, there were no significance differences between *yes respondents* and *no respondents* on the chronic health conditions checklist. Overall, these findings suggest that individuals who acknowledge hearing loss will not report a greater number of *other* chronic health conditions compared to those who deny hearing loss.

The association between self-reported hearing loss and each of the chronic health conditions was assessed. There was not a significant association between any of the individual health conditions on the checklist, except for hearing impairment and sinusitis. Interestingly, *yes respondents* were more likely to report sinusitis than *no respondents*. An explanation of this finding might be that individuals who suffer from sinusitis, which often leads to middle ear dysfunction, also recognize that their hearing is diminished as a result.

Discrepant Report

A comparison of participants' responses to the self-report question (i.e., hearing loss) to their self-report of "hearing impairment" on the chronic health conditions checklist yielded an interesting finding. Seventeen participants showed a discrepancy. Discrepancies between self-reported hearing loss and self-reported hearing impairment

were assessed as a function of age and gender, but again no association was found. This finding suggests that older adults less than 75 years old are no more likely to report hearing loss yet deny hearing impairment than are older adults ages 75+ and vice versa. This was true for gender of participant as well. These evaluations may also have not been significant due to a small sample size.

When only evaluating *yes respondents*, significant effects were found when comparing those showing a discrepancy and those who did not show a discrepancy. Participants who reported hearing loss and hearing impairment also reported more self-perceived hearing handicap and rated their overall health to be poorer than those who reported hearing loss but who denied hearing impairment. No relationship between *yes respondents* and showing a discrepancy was found as a function of age and gender. This finding is consistent with the notion that if an individual is willing to report hearing loss and hearing problems, then they are also willing to recognize the psychosocial implications of hearing problems. In contrast, those who acknowledge hearing loss, but not hearing problems, may be denying the extent of the difficulties they are having, and would be likely to deny some of their problems on the HHIE-S (Hétu et al., 1983; Ventry & Weinstein, 1983).

It may be speculated that discrepancies existed because participants were normalizing their hearing loss as suggested by Hétu et al. (1993). Participants may have thought that hearing impairment meant hearing problems. This discrepancy might also be a way of preserving identity (Hansen, 1998). Therefore it is conceivable that older adults might be willing to report hearing loss because they view at least some degree of hearing loss as a normal part of the aging process. But if they feel that the hearing loss is not

problematic, they may indicate that they do not have hearing impairment. Their apparent differentiation of the terms “hearing loss” and “hearing impairment” may also result from a perspective that “impairment” tarnishes their view of themselves (and perhaps how others view them).

Another reason for this finding might be that hearing impairment was embedded in a list of other chronic health conditions. However, hearing loss is an invisible condition. It might be easier for patients to report chronic sinusitis, for example, if they constantly have post-nasal drip and sinus pressure because these are more obviously related to health. Perhaps some participants might not view hearing impairment as a chronic health condition, and therefore, a discrepancy resulted between self-reported hearing loss and hearing impairment.

Pure Tone Screening Criteria

There were three pure tone screening criteria used as a standard by which the self-report question was assessed. Two pure tone screening criteria (i.e., Ventry and Weinstein [1983] and Dancer and Jackson [1996]) used a 40 dB HL fence as suggested by Weinstein (2000) and one used a lower fence (ASHA, 1997). Although the goal of the present study was not to determine the best pure tone screening criteria to use when evaluating the hearing of older adults, nor could this be determined by the data, some general findings will be discussed.

When assessing the self-report question against these three criteria, there were differences between the two high-fence standards and the lower fence. Essentially, both high-fence criteria performed the same, with sensitivities in the lower 80% range and specificities in the mid-to-upper 40% range. This suggests that the self-report question more than adequately identifies those who fail the high-fence criteria (sensitivity), but

that it performs poorly in identifying participants who pass the higher-fence criteria (specificity). On the other hand, the self-report question lower fence performed moderately well for both sensitivity and specificity (62.5% and 66.7%, respectively).

There were significant differences between self-perceived hearing handicap, age, and overall health perception rating for both high-fence criteria (recall that a *t*-test was not conducted with the ASHA criterion as this additional test would have inflated the alpha). Participants who failed had significantly more self-perceived hearing handicap (social and emotional), poorer health perceptions (measured either by overall health perception ratings or number of chronic health conditions), and were older, than participants who passed. These findings suggest a relationship between these factors and whether an individual passes or fails these criteria.

It is not surprising that participants who failed the criteria were older because senescent changes in hearing result in a decline of hearing sensitivity. Thus, it would be expected that an 80 year-old person would have worse hearing thresholds than a 65 year-old person. Additionally, a moderate correlation exists between hearing sensitivity and self-perceived hearing handicap (Weinstein, 2000). In other words, on average, individuals with poorer hearing perceive more hearing handicap than persons with better hearing. Therefore, it would be expected that participants who failed the screening criteria, or had worse hearing sensitivity, would also report more hearing handicap than participants who passed the hearing screening. Finally, there may be an association with hearing and health (Bess et al., 1989; Pugh & Crandell, 2002). Therefore, it may not be surprising that participants who failed the hearing screening would also report worse health perception ratings as was found in the current study.

Lastly, participants who failed the screening criteria were more likely to report hearing loss on the self-report question. McDavis (1983) alluded to a similar finding. She hypothesized that individuals with greater hearing loss would be more likely to acknowledge their loss. She found trends in her data to support this hypothesis and felt that this was because more communication problems would probably exist for individuals with worse hearing sensitivity.

Self-Perceived Hearing Handicap Screening Criteria

Two self-perceived hearing handicap criteria were used as a standard by which the self-report question was assessed. One criterion, HHIE-S >8 was suggested by ASHA (1997) and the other criterion, HHIE-S >10 , was suggested by Ventry and Weinstein (1983). Again, some general findings will be discussed.

Essentially, the sensitivity of the self-report question using either self-perceived hearing handicap criteria as a gold standard was nearly 90% and the specificity was approximately 50%. These findings suggest that the self-report question more than adequately identifies those who fail by either criterion (sensitivity), but that it performs only moderately well in identifying participants who pass either criterion (specificity). In other words, there was essentially no difference between these two criteria when their relationship to the self-report question.

When further evaluating the HHIE-S >10 criterion (recall that a *t*-test was not conducted with the ASHA HHIE-S >8 criterion as this additional test would have inflated the alpha), significant differences were found for overall perceived health ratings. Those who failed either criterion reported worse overall health perception ratings. These findings suggest that a relationship exists between reporting health perceptions and self-perceived hearing handicap. This finding may suggest that if an older patient in the clinic

reports health problems during the case history, for example, that they may also report hearing problems and therefore, a screening measure like the HHIE-S might be a good tool to include. However, there was not a difference in age as seen with the pure tone screening criteria. This finding may suggest that, the very old are no more likely to report hearing handicap than are the young old.

Predicting Self-Reported Hearing Loss

A goal of this study was to determine whether any of the study factors predicted self-reported hearing loss. Of all the factors in the study, the only predictor of self-reported hearing loss was self-perceived hearing handicap when measured via the HHIE-S. In other words, the more self-perceived hearing handicap a person reported on the HHIE-S, the greater the probability of the person reporting a hearing loss. Therefore, the more emotional and social problems people feel as a result of a hearing loss, the more likely they are to acknowledge a hearing loss. This finding might suggest that before individuals decide to seek audiologic evaluations on their own (i.e., not being “dragged” to the audiologist by their family), they must first recognize the impact the hearing loss is having on their social and emotional well-being.

Types of Acknowledgement

Recall that some participants responded ‘yes’ to the self-report question while at the same time responding ‘no’ to the hearing impairment question on the chronic health conditions checklist. In addition, some participants responded ‘yes’ to the self-report question while at the same time reporting significant self-perceived hearing handicap. Therefore, it was concluded that varying degrees of hearing loss acknowledgement probably exist. Héту et al. (1993) alluded to the notion, especially for men, that individuals may acknowledge hearing loss (e.g., “I cannot hear certain sounds.”), but at

the same time deny that it has any communicative or psychosocial impact. Based on these conclusions, three types of acknowledgement were proposed. In addition, suggestions for alternative therapies, in addition and in lieu of hearing aid use, were recommended as possible ways to help patients acknowledge their hearing losses and ultimately comply with treatment recommendations that may be made at the initial clinic visit and/or in future visits. Bear in mind that these hearing loss acknowledgement types were developed based on a sample of non hearing aid users and that non hearing aid use does not automatically equate to denial of hearing difficulties as suggested by Maurer (1998).

Complete Acknowledgement

Individuals expressing complete acknowledgement would be characterized as voluntarily reporting hearing loss and hearing problems. These individuals most likely understand that hearing difficulties are impacting their life. In this study, a participant expressing complete acknowledgement most likely reported yes to the self-report question, yes to the hearing impairment question, and had greater self-perceived hearing handicap. On the other hand, these individuals may not be ready for hearing aid use, even if they were candidates for them. Therefore, a patient should be interviewed to determine their hearing needs, prior to the recommendation of hearing aids.

This does not mean that hearing aids are the ultimate treatment option for one expressing complete acknowledgement. Rather, they are one of many options. As Holmes (1995) pointed out, the provision of hearing aids happens to be the primary recommendation and treatment for older adults with hearing loss.

In lieu of or in addition to hearing aids, other treatments can be suggested. These include the provision of assistive listening devices, Living with Hearing Loss classes, speechreading classes, communication strategies training, bibliotherapy, and counseling.

Counseling and education for those conveying complete acknowledgement might focus on how various treatments work, how hearing loss affects quality of life, and how quality of life can be improved through treatment.

Partial Acknowledgement

In this study, some participants responded yes to the self-report question and no to the hearing impairment question. In addition, some participants responded yes to the self-report question, but did not report significant self-perceived hearing handicap. This would describe the type of hearing loss acknowledgement called partial acknowledgment. With partial acknowledgement, individuals may report hearing loss, but without awareness of its impact on communication or psychosocial factors. These individuals were also alluded to by Hétu et al. (1993).

These individuals would most likely balk at the recommendation of hearing aids, although that would be the typical recommendation from most audiologists if the severity of the hearing loss implied that the individual should be a hearing aid candidate. If the individual did not comply with that recommendation, then s/he would most likely leave the clinic without hearing aids and would not receive additional therapy or counseling. Instead, audiologists might want to suggest education and counseling first. That would allow this type of patient to enter the rehabilitation process sooner because the audiologist would be offering a treatment that is more likely to be acceptable to this type of patient. In addition, this may allow the patient to better understand the effects of the hearing loss on quality of life, family and friends, etc., as well as treatment options.

Alternate recommendations might be Living with Hearing Loss classes, bibliotherapy (focusing on hearing loss and its symptoms), speechreading, communication strategies training, and/or assistive listening devices. Individuals

reporting partial acknowledgement might also benefit from a task that might help them realize the communication difficulties they are having, such an auditory-only word list or an introduction to common communication breakdowns.

On the other hand, an individual who reports hearing loss and denies hearing problems may be aware of the impact of their hearing loss. It may just be that some older adults know they have a hearing loss, but they are not bothered by it and have learned to cope with the loss according to their needs and lifestyle. Therefore, patients should not be pushed into counseling, education, or other treatment options if they do not want or perceive the need for them. Rather their views should be respected.

Non-Acknowledgement

A person conveying non-acknowledgement is one who does not report hearing loss and/or hearing problems. Non-acknowledgement may occur deliberately for individuals who knowingly have hearing difficulties, but do not want to admit hearing problems due to stigma, for example. Others may report non-acknowledgement because they are unaware of hearing difficulties they are having (Maurer, 1998).

It would be rare for a person who does not acknowledge hearing loss to comply with the treatment recommendation of hearing aid use. Instead, alternative therapies might include education concerning hearing loss and its symptoms and bibliotherapy on awareness and coping with hearing loss.

Limitations of the Study

There were several limitations of this study. Because this study was quasi-experimental, the researcher was unable to manipulate variables. Instead, variable manipulation occurred retrospectively by grouping participants in a variety of ways (e.g., *yes* and *no respondents* or *pass* and *fail* participants). A weakness of this design is that

interlocking relationships among variables in the study may not be able to be fully examined and therefore, causal statements cannot be made, rather only trends can be discussed.

Secondly, a limitation of this study was an inadequate sample size to evaluate some key factors. For example, it was of interest to determine whether age differences existed for hearing loss acknowledgement among a group of older adults. However, there were few very old adults to compare, and therefore age could not be divided into smaller subsets. This was also true for gender of participant as there were significantly more females in the study population than males.

Another limitation of this research was the utilization of a single question to represent the central concept of hearing loss acknowledgment. The reliability and validity of this single item is not yet established. It is possible, for example, that the discrepancy showed by some participants in responding to questions about hearing loss as opposed to hearing impairment was not a meaningful discrepancy. Instead, this discrepancy could reflect a lack of reliability of these questions. Future research should establish the test-retest reliability of questions about hearing loss.

In addition, conclusions about denial of hearing loss from this study must be tempered by the possibility that the respondents who are willing to enter a study related to hearing are those who have no problem with admitting a potential hearing loss. In fact, it is even possible that individuals who volunteered for the study were more likely to be people who were concerned about their hearing and wanted to receive a free screening for hearing difficulties. To control for this possibility, future investigations of hearing loss acknowledgment would need to be carried out with subject populations that were

recruited for research on other topics, e.g., memory or physical strength or something else unrelated to hearing.

Finally, no diagnostic audiometric data were obtained from the participants. Therefore, no claims as to which screening criteria were best could be made. In addition, no claims could be made as to which factors best predict actual hearing loss (i.e., defined by a true gold standard) as no audiometric data were obtained. Despite these limitations, some interesting findings were unveiled as a result of this study which suggests the value of some new approaches for audiologists working with older individuals with hearing loss.

Future Direction of Research

Future research in hearing loss acknowledgement is warranted based on the findings of this study. The concept of showing a discrepancy was very interesting to the researchers; however, it is not clearly understood. A study evaluating this in further detail might help explain the perceptions of older adults with respect to the meaning of different terminologies referring to “hearing loss,” “hearing impairment,” or “hearing problems.” Furthermore, the influence of factors such as age, gender, and health were not completely understood in this study, which warrants further investigation. Finally, the question of which screening criteria is best when testing older adults is still not clear. Research in this area might help audiologists who perform hearing screenings to be more effective.

Summary of Conclusions

Our results suggest that older adults do indeed acknowledge their hearing losses and this finding is encouraging. However, it must be noted that these participants, even when acknowledging existing hearing problems, do not own hearing aids. Acknowledging a hearing loss, seeking treatment for hearing loss, and complying with

treatment recommendations (i.e., hearing aids) are very different behaviors and the interplay of these behaviors is poorly understood. Audiologists often label older individuals as deniers just because they do not seek treatment for hearing loss or comply with treatment recommendations. Thus, the so called “denier”, who may acknowledge his/her hearing loss at least in part, would receive no further intervention. In recent years, audiologists have shown a growing interest in the provision of hearing aid post-fitting orientation and counseling programs. Research by Schow and his coauthors (1993) indicated that the majority of audiologists provide some form of education and audiologic rehabilitation to their patients after the fitting of hearing aids. Our results suggest that the scope of audiologic rehabilitation may need to be expanded to include pre-fitting counseling and education programs for older adults. Education regarding the effects of hearing loss on quality of life may be the key to increasing the number of older Americans who avail themselves of various rehabilitation options such as hearing aids and other forms of assistive technology so that they can live life to the fullest.

APPENDIX A RECORD FORMS

The following section represents the letters and record forms used to collect data in the study. All letters and questionnaires were approved to use by the University of Florida Institutional Review Board and were assigned a protocol number of 2001-603.



Would You Like a Hearing Screening at *No Charge?*

If you are 65 years of age or older **AND**
have **NEVER** worn hearing aids, you are
in luck!

What do I have to do?

This hearing screening is part of a study being conducted at the University of Florida (Protocol # 2001-603). If you volunteer, you will have your ears examined, your hearing screened, and you will answer a few questions about your hearing and health. It only takes a one-time, 15-minute visit.

The results will be shared with you immediately.



Interested volunteers should call Dr. Sherri Smith at
(352) 392-2113 X250 for more information or to sign up.

Figure A-1: Original flyer that was distributed for participant recruitment

Informed Consent Letter

The following letter was used to obtain informed consent from older individuals who were interested in participating in the study. It was, however, typed in size 16-point font. The protocol was renewed by the University of Florida Institutional Review Board through June 27, 2003.

June 17, 2002

Dear Participant,

I am presently conducting a study at the University of Florida Speech and Hearing Clinic to determine the relationships among health status, hearing status, acknowledgement of hearing difficulties, and self-reported hearing handicaps perceptions in elders. I would like to have you participate in this study.

The procedure involves having your ear canals examined with an ear light for debris such as wax. You will then listen for very soft tones presented to each ear with a hand-held device and you will raise your hand if you hear them. Questions regarding your hearing abilities, health status, and any hearing difficulties will be asked. This will involve approximately 20 minutes of your time. I will then examine the results to determine the relationship between your hearing status, health status, self-reported hearing handicap perception, and acknowledgement of hearing status.

All test results and information obtained from this investigation will be kept confidential to the extent provided by law. Participant information will be kept on a master roster available only to the Principal Investigator, her supervisor, and her research assistants to ensure confidentiality. Upon completion of this investigation, the master roster will be destroyed. Each participant will be assigned an identification number, using a system of initials and numbers, to code all forms and information pertaining to participants. Identity will not be revealed should results of this research be published. Data will be kept for future use.

Your participation is completely voluntary. Responses to questions are also completely voluntary. There will be no discomfort or risk involved in this study. You are free to withdraw from this project at any time. Foreseen benefits associated with participation in this study include report of your hearing status and a listing of community

audiologists if desired. No monetary compensation will be available. Thank you for your cooperation.

Sincerely,

Sherri L. Smith, Au.D.
Doctor of Audiology/ Ph.D. Student

Patricia B. Kricos, Ph.D.
Professor/Director of Audiology

If you agree to participate in this investigation, please fill out the form below.

I have read and understand the information contained in this form and give my consent to participate in this research project.

Signature of Participant: _____

Name (please print): _____

Date of Birth: _____

Telephone #: _____

Signature of Witness: _____

Print Name: _____

Signature of Principle Investigator: _____

Today's Date: _____

Questions and concerns about the research participants' rights can be directed to the UFIRB office, PO Box 112250, University of Florida, Gainesville FL 32611-2250. If you have any questions or concerns regarding any of the procedures used during the course of this research project, please feel free to contact me at the telephone number or address below.

Sherri L. Smith, Au.D.
Department of Communication Sciences and Disorders
336 Dauer Hall
Gainesville, FL 32611
(352) 392-2113

or

Patricia B. Kricos, Ph.D.
Department of Communication Sciences and Disorders
337 Dauer Hall
Gainesville, FL 32611
(352) 392-2113

Approved for use through August 2002

Record Forms**Chronic Health Conditions Checklist**

Subject ID: _____

Gender: M F

Age: _____ years

_____ Arthritis

_____ Hypertension

_____ Hearing Impairment

_____ Heart Disease

_____ Sinusitis

_____ Orthopedic Impairment

_____ Cataracts

_____ Diabetes

_____ Visual Impairments

_____ Tinnitus

Figure A-2: Chronic health conditions checklist record form

Hearing Handicap Inventory for the Elderly-Screening Version

Hearing Handicap Inventory for the Elderly-Screening Version (HHIE-S)		Yes (4)	Sometimes (2)	No (0)
E-1.	Does a hearing problem cause you to feel embarrassed when you meet new people?	___	___	___
E-2.	Does a hearing problem cause you to feel frustrated when talking to members of your family?	___	___	___
S-3.	Do you have difficulty hearing when someone speaks in a whisper?	___	___	___
E-4.	Do you feel handicapped by a hearing problem?	___	___	___
S-5.	Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?	___	___	___
S-6.	Does a hearing problem cause you to attend religious services less often than you would like?	___	___	___
E-7.	Does a hearing problem cause you to have arguments with family members?	___	___	___
S-8.	Does a hearing problem cause you difficulty when listening to TV or radio?	___	___	___
E-9.	Do you feel that any difficulty with your hearing limits or hampers your personal or social life?	___	___	___
S-10.	Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?	___	___	___
E Total:		___	___	___
S Total:		___	___	___
Total:		___	___	___

Figure A-3: The HHIE-S record form (Ventry & Weinstein, 1983)

Referral Form


**UNIVERSITY OF
FLORIDA**

 Department of Communication Sciences &
Disorders

 336 Dauer Hall
P.O. Box 117420
Gainesville, Florida 32611-7420
(352) 392-2113
Fax (352) 846-0243

Name _____

Date _____

Thank you for participating in the University of Florida hearing study (#2001-603) today. Based on the screening results and our discussion, the following recommendations were made today (where checked):

Testing

- ☐ Full audiologic test by licensed audiologist
- ☐ Re-screen hearing in 1 year or if a change is noticed
- ☐ Tinnitus evaluation by licensed audiologist
- ☐ Hearing aid(s) evaluation by licensed audiologist, if interested

Medical Evaluation

- ☐ Earwax removal by primary care physician
- ☐ Examination of outer ear or middle ear by physician
re: _____
- ☐ Other: _____

Figure A-4: Results and referral record form given to participants upon completion of the study

Gainesville, Florida Area Audiology List**Gainesville Area Audiology Clinics**

Listed in Alphabetical Order

- 1. Audiology Associates**
4340 Newberry Road (352) 372-9414
- 2. Department of Communicative Disorders
Shands at UF**
UF Health Science Center
1600 SW Archer Road
2nd Floor Dental Tower (352) 392-2012
- 3. ENT at Ayers**
Ayers Medical Plaza
720 SW 2nd Avenue (352) 338-7151
- 4. The Hearing Center**
Dr. David Walker, Audiologist
6821 NW 11th Place (352) 333-3060
- 5. Dr. Joseph D. Sparks**
1225 NW 10th Avenue (352) 375-1559
- 6. University of Florida Speech and Hearing Clinic**
435 Dauer Hall, UF (352) 392-2041

Figure A-5: List of Gainesville, Florida area audiologists that was given to interested participants

Lake City, Florida Area Audiology List**Lake City Audiologists**

Listed in alphabetical order:

1. Althea L.E. Rho Grey, M.A.
Lake City Hearing Center
4551 West US 90, Suite 101
Lake City, FL 32055
386-719-6585

2. Debra K. Griffin, Au.D.
Hearing Solutions, Inc.
55B N. 7th St.
Lake City, FL 32055
386-758-3222
email: heargrif@isgroup.net

Figure A-6: List of Lake City, Florida area audiologists that was given to interested participants

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BIOGRAPHICAL SKETCH


Sherri Lyn Smith was born and raised in Bradenton, Florida. She obtained her Bachelor of Arts degree with highest honors, majoring in speech-language pathology and audiology, in May 1997 from the University of Florida, Gainesville, Florida. In December 1999, she completed her Master of Arts (M.A.) degree, thesis-option, at the University of Florida with a major in audiology. Her thesis was entitled the *Intelligibility of Speech from the Uterus of a Pregnant Ewe and from the Fetal Inner Ear*, which she completed under the direction of Dr. Kenneth J. Gerhardt. Immediately following the completion of her M.A., Sherri transitioned into the on-campus Doctor of Audiology (Au.D.) program at the University of Florida from which she graduated in May 2001.

Dr. Smith has been a licensed audiologist in the State of Florida since 2001. She also holds her Certificate of Clinical Competence in Audiology issued by the American-Speech-Language-Hearing Association and is Board Certified in Audiology by the American Board of Audiology. Dr. Smith's immediate family consists of her long-time significant other, Rodney Housen.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Patricia B. Kricos, Chair
Professor of Communication Sciences and
Disorders


I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Robin Lea West, Cochair
Associate Professor of Psychology


I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Kenneth J. Gerhardt
Professor of Communication Sciences and
Disorders

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Scott K. Griffiths
Associate Professor of Communication
Sciences and Disorders

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Alice E. Holmes
Associate Professor of Communicative
Disorders

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

A handwritten signature in dark ink, appearing to read 'Robert M. Beland', written over a horizontal line.

Robert M. Beland
Associate Professor of Recreation, Parks,
and Tourism

This dissertation was submitted to the Graduate Faculty of the Department of Communication Sciences and Disorders in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 2003

Dean, Graduate School